



Department of Energy

ROCKY FLATS FIELD OFFICE
P.O. BOX 928
GOLDEN, COLORADO 80402-0928

FEB 22 1999

99-DOE-03276



Mr. Steve Gunderson
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South
Denver, Colorado

Dear Mr. Gunderson:

Enclosed please find a copy of the *Draft Sampling Analysis Plan Site Characterization of Bowman's Pond (PAC-700-1108) and Steam Condensate Holding Tanks (IHSS 139.1(N) RF/RMRS-98-296* for your organization's review and comment. The U.S. Department of Energy Rocky Flats Field Office requests that agency comments be returned by March 4, 1999, to support the sampling schedule.

If you should have any technical questions related to this sampling plan, please contact Norma I. Castaneda at (303) 966-4226 or contact me at (303) 966-5918.

Sincerely,

Joseph A. Legare
Assistant Manager
for Environment and Infrastructure

Enclosure

cc w/Enc:

A. Rampertaap, EM-40, HQ
R. DiSalvo, OCC, RFFO
C. Spreng, CDPHE
G. Kleeman, EPA
T. Rehder, EPA
Administrative Record

cc w/o Enc:

R. Tyler, ERWM, RFFO
N. Castaneda, ERWM, RFFO
L. Butler, K-H

ADMIN RECCRD
IA -A-00158



DRAFT
SAMPLING ANALYSIS PLAN
SITE CHARACTERIZATION OF
BOWMANS POND
(PAC-700-1108) AND
STEAM CONDENSATE
HOLDING TANKS
(IHSS 139.1N)

RF/RMRS-98-296



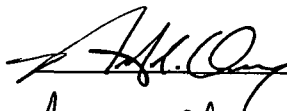
February 16, 1999
Revision 0

DRAFT
SAMPLING ANALYSIS PLAN
SITE CHARACTERIZATION OF
BOWMANS POND (PAC-700-1108) AND STEAM
CONDENSATE HOLDING TANKS (IHSS 139.1N)

Revision No. 0
Document Control No: RF/RMRS-98-296

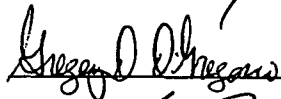
Rocky Mountain Remediation Services, L.L.C.
February 16, 1999

Project Manager




Date 2-17-99

Quality Assurance



Date 2-17-99

Radiological Engineering



Date 2/17/99

Document Classification
Review Waiver Per
Classification Office
CEX-010-98

TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
1.1	BACKGROUND.....	1
1.2	DATA SUMMARY	4
1.2.1	SURFACE WATER.....	4
1.2.2	FOOTING DRAINS.....	5
1.2.3	SEDIMENT AND SURFACE SOIL	6
1.2.4	GROUNDWATER.....	7
1.2.5	SUMMARY	8
1.3	HYDROGEOLOGIC AND CONTAMINANT SETTING	9
1.4	OBJECTIVES	9
2.0	SAMPLING RATIONALE AND DATA QUALITY OBJECTIVES.....	10
2.1	STATE THE PROBLEM.....	10
2.2	IDENTIFY THE DECISION	10
2.3	IDENTIFY INPUTS TO THE DECISION.....	11
2.4	DEFINE THE INVESTIGATION BOUNDARIES	11
2.5	DEVELOP A DECISION RULE	11
2.5.1	SURFACE WATER.....	11
2.5.2	SEDIMENTS AND SOILS	12
2.6	SPECIFY LIMITS ON DECISION ERRORS	13
2.7	OPTIMIZATION OF DESIGN	13
3.0	SAMPLING ACTIVITIES AND METHODOLOGY	13
3.1	SOIL BORINGS AND POND SEDIMENT SAMPLING	13
3.2	SURFACE WATER SAMPLING	15
3.3	SAMPLE HANDLING	17
3.4	EQUIPMENT DECONTAMINATION/WASTE HANDLING	17
4.0	PROJECT ORGANIZATION.....	18
5.0	QUALITY ASSURANCE.....	19
6.0	SCHEDULE.....	21
7.0	REFERENCES.....	21

LIST OF TABLES

Table 1.2.1	Summary of Maximum Analytical Results – Surface Water	4
Table 1.2.2	Summary of Maximum Foundation Drain Analytical Results, FD 774-1	5
Table 1.2.3	Summary of Maximum Historical Analytical Results – Sediment (SED124)	6
Table 1.2.4	PCB Analytical Results, May 1991	7
Table 1.2.5	Summary of Maximum Analytical Results – Groundwater (Well P219189)	7
Table 1.2.6	Summary of Available Data and Resulting PCOCs by Medium for Bowmans Pond and IHSS 139.1 (N).....	8
Table 3.1	Field Program	15
Table 3.2	Analytical Program.....	17
Table 5.1	QA/QC Sample Type, Frequency, and Quantity	19
Table 5.2	PARCC Parameter Summary	21

LIST OF FIGURES

Figure 1.1 Location Map, Bowmans Pond (PAC-700-1108) and Steam Condensate Holding Tanks (IHSS 139.1N)	2
Figure 1.2 Sample Location Map, Bowmans Pond (PAC-700-1108) and Steam Condensate Holding Tanks (IHSS 139.1N)	3
Figure 3.1 Proposed Sample Location Map, Bowmans Pond (PAC-700-1108) and Steam Condensate Tanks (IHSS 139.1N)	14
Figure 4.1 Bowmans Pond Characterization Project Organization Chart.....	18

APPENDIX

- A Required Detection Limits (18 Pages)
- B Field Forms (2 Pages)

LIST OF ACRONYMS

ALF	Action Levels and Standards Framework
ASD	Analytical Services Division
APO	Analytical Projects Office
CDPHE	Colorado Department of Public Health and Environment
DOE	US Department of Energy
DQO	Data Quality Objective
EPA	Environmental Protection Agency
ERM	Environmental Restoration Management
FO	Field Operations
GT	Geotechnical
GPS	Global Positioning System
IDM	Investigative Derived Material
IHSS	Individual Hazardous Substance Site
KH	Kaiser-Hill Company, Inc.
mg/Kg	milligrams per kilogram
mg/L	milligrams per Liter
nCi/g	Nanocuries Per Gram
NFA	No Further Action
OU	Operable Unit
OVM	Organic Vapor Meter
pCi/g	Picocuries Per Gram
pCi/L	Picocuries Per Liter
PAC	Potential Area of Concern
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PCB	Polychlorinated Biphenyl
PCOC	Primary Contaminant of Concern
POE	Point of Evaluation
QAPD	Quality Assurance Project Description
QA	Quality Assurance
QC	Quality Control
RFI/RI	Resource Conservation and Recovery Act Facilities Investigation/Remedial Investigation
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site

LIST OF ACRONYMS – Cont.

RMRS	Rocky Mountain Remediation Services, L.L.C.
ROD	Record of Decision
RPD	Relative Percent Difference
SAP	Sampling Analysis Plan
SOP	Standard Operating Procedure
SOW	Statement of Work
SVOC	Semivolatile Organic Compound
SW	Surface Water
SWD	Soil and Water Database
ug/L	Micrograms per Liter
ug/Kg	Micrograms per Kilogram
VOC	Volatile Organic Compound

STANDARD OPERATING PROCEDURES

<u>NUMBER</u>	<u>PROCEDURE TITLE</u>
Procedure No. FO.1, Rev. 3	Air Monitoring and Particulate Control
5-21000-OPS-FO.03	Field Decontamination Procedures
RMRS/OPS-PRO.112	Handling of Decontamination Water and Wash Water
RMRS/OPS-PRO.128	Handling and Containerizing Drilling Fluids and Cuttings
4-K55-ENV-OPS-FO.10	Receiving, Marking, and Labeling Environmental Materials Containers
5-21000-OPS-FO.11	Field Communications
RMRS/OPS-PRO.141	Decontamination Facility Operations
RMRS/OPS-PRO.069	Containing, Preserving, Handling and Shipping of Soil and Water Samples
5-21000-OPS-FO.15	Photoionization Detectors and Flame Ionization Detectors
RMRS/OPS-PRO.101	Logging Alluvial and Bedrock Material
RMRS/OPS-PRO.117	Plugging and Abandonment of Boreholes
RMRS/OPS-PRO.102	Borehole Clearing
RMRS/OPS-PRO.126	Surface Water Data Collection Activities
RMRS/OPS-PRO.081	Surface Water Sampling
RMRS/OPS-PRO.085	Pond Sampling
5-21000-OPS-SW.17	Pond and Reservoir Bottom Sediment Sampling
1-F20-ER-EMR-EM.001	Approval Process for Construction/Excavation Activities
2-S47-ER-ADM-05.14	Use of Field Logbooks and Forms
RF/RMRS-98-200	Evaluation of Data for Usability in Final Reports
1-50000-ADM-12.01	Control of Measuring and Test Equipment
3-21000-ADM-17.01	Quality Assurance Records Requirements
RMRS-QAPD-001	RMRS Quality Assurance Program Description
1-C88-WP1027-NONRAD	Non-Radioactive Waste Packaging
1-M12-WO4034	Radioactive Waste Packaging Requirements
4-C77-WO-1101	Solid Radioactive Waste Packaging
1-C80-WO-1102-WRT	Waste/Residue Traveler Instructions
PADC-96-00003	WSRIC for OU Operations, Version 6.0, Section No. 1
1-PRO-079-WGI-001	Waste Characterization, Generation, and Packaging

1.0 INTRODUCTION

This Sampling Analysis Plan (SAP) for the characterization of Bowmans Pond and Individual Hazardous Substance Site (IHSS) 139.1N (i.e., the steam condensate tanks [T-107 and T-108]) summarizes the existing data, delineates data gaps, and describes the sampling methodology, project organization, quality assurance, and schedule required to characterize potential contamination of soil, sediment, and surface water. Bowmans Pond is referenced as Potential Area of Concern (PAC) 700-1108 at the Rocky Flats Environmental Technology Site (RFETS). The two steam condensate tanks (T-107 and T-108), are referenced as part of IHSS 139.1N. Contamination will be measured against the Action Levels and Standards Framework (ALF) for Surface Water, Ground Water, and Soils of the Rocky Flats Cleanup Agreement (RFCA) (DOE, 1996) or by the Applicable or Relevant and Appropriate Requirements (ARARs) established for the Industrial Area. Based on the available data Bowmans Pond is ranked 28th and IHSS 139.1N is ranked 60th on the Environmental Restoration Ranking of priority sites (RMRS, 1998). Together, these sites and the surrounding area, comprise the depositional environment for the Building 700 area effluent. This project will be performed in accordance with the applicable Federal, State, and local regulations, as well as DOE Orders, RFETS policies and procedures, and Environmental Restoration Operating Procedures.

1.1 Background

Bowmans Pond and IHSS 139.1N are located north of Building 774 (Figure 1.1). Bowmans Pond consists of a small depression approximately 3 to 4 feet (ft) deep with an areal extent of approximately 28 ft by 33 ft (Figure 1.2). Previous investigations indicate that Bowmans Pond surface water and sediments have been impacted by run off from the area upgradient of the pond and water received from a storm drain and footing drains from Buildings 771 and 774. Additionally, releases to Bowmans Pond, resulting from the steam condensate tanks (IHSS 139.1N) and a process waste line leak are discussed in the Historical Release Report (DOE, 1992). T-107 and T-108 are aboveground tanks with a capacity of 8,000-gallons. The riveted steel tanks received overflow and contained liquid from a bermed area around a sodium hydroxide product tank located immediately south of Building 774 (Figure 1.2). The tank bottoms are badly corroded (DOE, 1992). Overflow from Bowmans Pond to the tank area has also potentially affected the tank area.

The analytical data available to characterize releases to Bowmans Pond are presented in the Draft Operable Unit (OU) 8 Investigation of Footing Drains-Technical Memorandum No. 1 (EG&G, 1994) and Draft OU 8 Data Summary Technical Memorandum No. 2 (EG&G, 1995). Surface water monitoring station SW086, located down gradient of Bowmans pond, provides analytical

data to characterize water quality from Bowmans Pond (Figure 1.2). A sump located adjacent to SW086 diverted Bowmans Pond water to the Solar Evaporation Ponds Interceptor Trench System; however, it can not be verified by site visits or interviews with RFETS personnel if the sump is operational or has been operational since 1990.

1.2 Data Summary

Existing data for surface water, the Building 771 and 774 footing drains, sediment, surface soil, and groundwater from locations in the vicinity of Bowmans Pond, and IHSS 139.1(N) were compiled for use in identifying the potential contaminants of concern (PCOCs) and data gaps to be addressed by this SAP. The maximum concentration of each analyte detected is presented in Tables 1.2.1 through 1.2.5 for each medium.

1.2.1 Surface Water

Analytical results for surface water samples from monitoring locations SW084, SW086, and SW124 are presented in Table 1.2.1. As illustrated on Figure 1.2, SW084 and SW124 are upgradient of the pond and may be indicative of inflow to the pond from the surrounding area. SW086 is located downgradient of the pond, and although data are limited, can be used to estimate water quality from Bowmans Pond. The maximum concentrations detected at these locations were compared to surface water action levels and standards for the Segment 5, Point of Evaluation (POE) provided in Attachment 5 of RFCA (DOE, 1996). Analytes with maximum concentrations exceeding the referenced action levels are bolded in Table 1.2.1 and represent PCOCs.

Table 1.2.1 Summary of Maximum Analytical Results – Surface Water

Location	Date	Description	Result	Unit	Action Level, Segment 5 POE
SW086	4/16/90	1,1,1-Trichloroethane	5	ug/L	200
SW084	5/8/89	Acetone	110	ug/L	3650
SW124	4/17/91	Aroclor-1254	12	ug/L	1 ^a
SW084	4/11/89	Beryllium	3.6	ug/L	4
SW084	3/20/90	Carbon Tetrachloride	130	ug/L	5
SW084	3/20/90	Chloroform	40	ug/L	6
SW084	12/19/89	Chromium	298	ug/L	50
SW084	12/19/89	Cobalt	13.7	ug/L	NA
SW084	12/19/89	Copper, total	216	ug/L	16 (dissolved) ^b
SW084	7/17/90	Cyanide	3	ug/L	5
SW084	12/19/89	Lead, total	189	ug/L	6.5 (dissolved) ^b
SW084	6/26/90	Lithium	1170	ug/L	NA
SW084	12/19/89	Nickel, total	171	ug/L	123 (dissolved) ^b
SW086	6/6/89	Nitrate/Nitrite	25	mg/L	100 (10) ^c

Table 1.2.1 (continued).

SW086	7/11/88	Oil & Grease	253	mg/L	NA
SW084	6/26/90	Strontium	5850	ug/L	NA
SW086	4/16/90	Tetrachloroethene	5	ug/L	5
SW086	9/10/90	Toluene	10	ug/L	1000
SW084	12/19/89	Zinc	2970	ug/L	141
SW084	2/16/90	Am-241	3.9	pCi/L	0.15 ^d
SW086	10/10/90	Pu-239/240	0.5424	pCi/L	0.15 ^d
SW086	5/7/90	Sr-89/90	9855	pCi/L	8 ^d
SW086	9/10/90	Tritium	1188.96	pCi/L	500 ^d
SW084	5/7/90	U-233/234^f	7.98	pCi/L	10 ^{d,e}
SW086	1/25/90	U-235	0.31	pCi/L	10 ^{d,e}
SW086	5/7/90	U-238^f	6.58	pCi/L	10 ^{d,e}

Note: Bolded analytes equal or exceed Segment 5, Point of Evaluation (POE) action levels.

a) The practical quantitation limit (PQL) for aroclor-1254 (1 ug/L) is greater than the action level (0.5 ug/L). Per RFCA, the action level defaults to the PQL.

b) Measured concentration is for an unfiltered sample; the action level is for a filtered sample.

c) 100 mg/L is an interim standard

d) The action level is a site-specific standard for Walnut Creek

e) The action level is for a total U measurement rather than isotopic

f) Adding the U-233/234 and U-238 activities for the sample collected from 5/7/90 results in a total activity exceeding the action level

1.2.2 Footing Drains

The footing drain and storm drain waters from Buildings 771 and 774 (and the 700 Area in general) have been routinely released to Bowmans pond and, as a result, represents a potential source of contamination to the pond and surrounding area as illustrated in Figure 1.2. Analytes detected in samples collected from footing drain FD-774-1 previous to and during the OU 8 investigation (EG&G, 1994) is presented in Table 1.2.2. Comparability in the occurrence and concentrations of tritium, lead, chromium, copper, strontium, and zinc between surface water and the footing drain water is noted. Analyte concentrations appear to decrease between the 1989 and the 1993 sampling events. No flow was observed in footing drain FD-774-2 during the sampling events.

Table 1.2.2 Summary of Maximum Foundation Drain Analytical Results, FD 774-1

Date	Description	Result	Units	Action Level, Segment 5 POE
Jun-80	Tritium	4,681	pCi/L	500
Jun-80	Nitrate as Nitrogen	108.5	mg/L	100
4/26/89	Lead	363	ug/L	6.5 (dissolved)
4/26/89	Chromium	54	ug/L	50
4/26/89	Copper	360	ug/L	16 (dissolved)
4/26/89	Nickel	71	ug/L	123 (dissolved)
4/26/89	Strontium	700	ug/L	NA
4/26/89	Zinc	7,300	ug/L	141
1992-1993 Metals Data				
3/27/93	Lead	6	ug/L	6.5 (dissolved)
3/27/93	Chromium	<5	ug/L	50

Table 1.2.2 - Continued

3/27/93	Copper	12	ug/L	16 (dissolved)
3/27/93	Nickel	<13	ug/L	123 (dissolved)
3/27/93	Strontium	274	ug/L	NA
3/27/93	Zinc	154	ug/L	141

Note: Bolded analytes equal or exceed Segment 5, Point of Evaluation (POE) action levels. No VOCs or SVOCs were detected in March 1993 sampling event.

1.2.3 Sediment and Surface Soil

Sediment monitoring location SED124 corresponds with surface water monitoring location SW124 (Figure 1.2) and is located upgradient of Bowmans Pond. The analytical results for SED124 are presented on Table 1.2.3. The results indicate elevated levels of the PCB aroclor-1254 and benzo(a)pyrene as compared to RFCA Tier II surface soil action levels for the Industrial Area. Radionuclides are observed in the range of 0.1 to 2.2 pCi/g. Tritium, measured in the interstitial water from the sediment samples, was observed at a maximum of 794.7 pCi/L.

Five sediment samples (SED80293 through SED80693) were collected from around the two steam condensate tanks as part of the OU 8 Phase I RFI/RI as shown in Figure 1.2 (EG&G, 1995). These five sediment samples were only analyzed for metals and VOCs with no positive results above the Tier II ALF values for the respective analytes (EG&G, 1995).

Table 1.2.3 Summary of Maximum Historical Analytical Results – Sediment (SED124)

Date	Description	Result	Unit	Surface Soil/Industrial	
				Tier II	Tier I
3/25/91	4-Nitroaniline	5.3	mg/Kg	NA	NA
3/25/91	Americium-241	0.8585	pCi/g	38	209
3/25/91	Anthracene	2.9	mg/Kg	613000	6130000
12/17/90	Antimony	7	mg/Kg	818	818
3/25/91	Aroclor-1254	67	mg/Kg	0.743	74.3
4/16/91	Arsenic	5.1 ^a	mg/Kg	3.27	327
3/25/91	Benzo(a)Anthracene	7.1	mg/Kg	7.84	784
3/25/91	Benzo(a)Pyrene	6.3	mg/Kg	0.784	78.4
3/25/91	Benzo(b)Fluoranthene	7.1	mg/Kg	7.84	784
3/25/91	Benzo(ghi)Perylene	5.7	mg/Kg	NA	NA
3/25/91	Benzo(k)Fluoranthene	6.3	mg/Kg	78.4	7840
8/20/91	Beryllium	0.86	mg/Kg	1.33	133
4/16/91	Cesium-134	0.1187	pCi/g	NA	NA
12/17/90	Chromium	49.5	mg/Kg	>1E+6	>1E+6
3/25/91	Chrysene	8.2	mg/Kg	784	78400
9/19/90	Dibenzo(a,h)Anthracene	1.2	mg/Kg	0.784	78.4
3/25/91	Indeno(1,2,3-cd)Pyrene	5	mg/Kg	7.84	784
3/25/91	Phenanthrene	16	mg/Kg	NA	NA
3/25/91	Plutonium-239/240	1.129	pCi/g	252	1088

Table 1.2.3 – Continued

3/25/91	Pyrene	19	mg/Kg	61300	613
4/16/91	Radium-226	2.2	pCi/g	0.0247	2.47
4/16/91	Selenium	0.94	mg/Kg	1.02E+04	1.02E+04
4/16/91	Strontium	53	mg/Kg	>1E+6	>1E+6
3/25/91	Strontium-89,90	0.1378	pCi/g	57.2	5720
3/25/91	Tritium	794.7 ^b	pCi/L	44800	4.48E+06

Note: Bolded analytes exceed relevant Tier II surface soil action level for Industrial Use.

- a) The arsenic concentration is above the action level but is below background.
- b) Tritium value exceeds surface water action level; Tritium sample collected from interstitial water from sediment sample.

As a result of the elevated aroclor-1254 concentration detected at SED124 (67,000 ug/Kg), PCB occurrence in the area was investigated further as part of a follow up investigation in May 1991. Sample locations are shown on Figure 1.2 and the results are summarized in Table 1.2.4 (EG&G, 1991). A maximum concentration of 8,700 ug/Kg aroclor-1254 was observed at site PCB-31-13 on the northwest (or west) side of Bowmans Pond (Figure 1.2). Overall, seven of the samples have aroclor-1254 concentrations above the Tier II ALF for aroclor-1254.

Table 1.2.4 PCB Analytical Results, May 1991

Location	Aroclor-1254 (ug/Kg)
PCB31-6	25
PCB31-7	33
PCB31-8	< 21
PCB31-9	230
PCB31-10	1,500
PCB31-11	3,700
PCB31-12	1,600
PCB31-13	8,700
PCB31-14	4,300
PCB31-15	220
PCB31-16	2,300
PCB31-17	1,800

Note: < = Analyte not detected at or above the listed method reporting limit, (EG&G, 1991). Bolded sample locations indicate the analyte exceeded the Tier II action level for aroclor-1254, which is 743 ug/Kg.

1.2.4 Groundwater

Groundwater data in the vicinity of Bowmans Pond and T-107 and T108 is limited. The maximum concentration of analytes detected from November 1993 through June 1998 from monitoring well P219189, which is located upgradient of Bowmans Pond (Figure 1.2), are presented in Table 1.2.5. Only results for Volatile Organic Compounds (VOCs) and tritium were available.

Table 1.2.5 Summary of Maximum Analytical Results – Groundwater (Well P219189)

Date	Description	Result	Units	Tier II	Tier I
11/18/93	1,1,1-Trichloroethane	12	ug/L	200	20000
6/15/98	1,1,2-Trichloroethane	1	ug/L	5	500
11/18/93	1,1-Dichloroethane	58	ug/L	1,010	101000

Table 1.2.5- Continued

11/18/93	1,1-Dichloroethene	49	ug/L	7	700
2/8/94	1,2-Dichloroethane	0.3	ug/L	5	500
8/10/94	1,2-Dichloropropane	0.7	ug/L	5	500
6/15/98	Carbon Tetrachloride	7	ug/L	5	500
6/15/98	Chloroform	2	ug/L	100	10000
6/15/98	Cis-1,2-Dichloroethene	1	ug/L	70	700
6/15/98	Methylene Chloride	2	ug/L	5	500
11/20/95	Nitrate/Nitrite	0.92	ug/L	10000	1000000
6/15/98	Tetrachloroethene	0.6	ug/L	5	500
8/10/94	Trichloroethene	0.4	ug/L	5	500
8/10/94	Tritium	990	pCi/L	666	66600

Note: Bolded analytes exceed Tier II groundwater action levels.

1.2.5 Summary

Table 1.2.6 represents a summary of the PCOCs identified using the available data. Although not well characterized, the data indicates that the Bowmans Pond and IHSS 139.1N area is a depositional environment for effluent from the Building 700 area. Further, the recipient area is contaminated with aroclor-1254 above action levels in several media of concern and potentially contaminated with radionuclides, heavy metals, VOCs, and semivolatile organics. An "NA" on Table 1.2.6 indicates that the medium has not been analyzed for that particular parameter. The most significant data gap for the site is surface soil and subsurface soil. Surface soil in the area has only been characterized for PCBs and subsurface soil has not been sampled. Additionally, given the age of the analytical results presented for surface water, sediments, and surface soil, these samples likely are not representative of current conditions at in the area. The data are not sufficient to characterize the extent or magnitude of the contamination at the site; therefore, future decisions regarding the disposition of Bowmans Pond and IHSS 139.1 (N) area (e.g., accelerated action, interim action, no further action) cannot be made.

Table 1.2.6 Summary of Available Data and Resulting PCOCs by Medium for Bowmans Pond and IHSS 139.1 (N)

PCOC	Media				
	Surface Water	Footing Drain	Sediment	Surface Soil	Groundwater
Aroclor-1254	X	NA	X	X	NA
Benzo(a)pyrene	ND	ND	X	NA	NA
Carbon Tetrachloride	X	ND	ND	NA	X
Chloroform	X	ND	ND	NA	ND
Chromium	X	X	X	NA	NA
Copper	X	X	ND	NA	NA
Lead	X	X	ND	NA	NA
Nickel	X	X	ND	NA	NA
Nitrate	X	X	ND	NA	NA
1,1-DCE	ND	ND	ND	NA	X
Tetrachloroethene	X	ND	ND	NA	ND
Zinc	X	X	ND	NA	NA
Am-241	X	NA	X	NA	NA

Table 1.2.6 - Continued

Pu-239/-240	X	NA	X	NA	NA
Ra-226	ND	NA	X	NA	NA
Sr-89/-90	X	NA	X	NA	NA
Tritium	X	NA	X	NA	NA

Note: X = Data is available, NA = No data available, ND = Data indicates no detection's.

1.3 Hydrogeologic and Contaminant Setting

Bowmans Pond and the steam condensate tanks are located on a northward sloping colluvial surface consisting of approximately 10 to 11 ft of gravelly to sandy clay and clay. Top of bedrock is approximately 11 ft below ground surface (bgs) and consists of claystone of the Laramie Formation as observed in the boring log from P219189 (Figure 1.2). Groundwater is observed to range between 6 and 8 ft. bgs in well P219189. Groundwater flows toward the north towards the apex of North Walnut Creek. The depth of sediment in Bowmans Pond is unknown and will be evaluated during this investigation.

Figure 1.2 depicts the footing drains and storm drains from the 700 area that daylight at Bowmans Pond and lead out from Bowmans Pond towards North Walnut Creek. Based on the location of Bowmans Pond and the surrounding area in general, the investigation area is considered a receptor and depositional environment for the Building 700 area effluent.

1.4 Objectives

The objective of this investigation is to characterize the nature and extent of contamination in surface soil, sediment, subsurface soil and surface water in the depositional environment for the Building 700 area effluent (Figure 1.2). The study area encompasses both Bowmans Pond and IHSS 139.1N. The existing characterization data are not sufficient to disposition the site as an accelerated action, interim action, or no further action.

Specifically, the objectives of the investigation are to:

- Characterize contamination of surface water and sediments in influents to and effluents from Bowmans Pond and Bowmans Pond itself
- Determine the nature and extent of contamination in surface soil and subsurface soil for the surrounding depositional environment which encompasses the area adjacent to Bowmans Pond and IHSS 139.1N

As indicated in Section 1.2.5, samples of surface water, sediment, surface soil, and subsurface soil analyzed for the PCOCs (PCBs, metals, VOCs, SVOCs, PCBs, and isotopic radionuclides) are necessary to estimate the extent and magnitude of contamination. Characterization data

collected will be of sufficient and defensible (validated and verified) quality to disposition the site for further action or NFA.

2.0 SAMPLING RATIONALE AND DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) to meet the objectives described in Section 1.4 were developed based upon review of available analytical data (Section 1.2). Establishing requirements for the characterization involve identifying the decisions to be made, as well as the data needed to make these decisions. Implementation of EPA's DQO process is necessary to determine the data needs for the project and to optimize the number and types of measurements and analyses relative to the available resources and ultimate project decisions. The DQO process is a systematic means to ensure that data collected, either historical or newly acquired, is legally and technically defensible so that decisions based on the data will, likewise, be legally and technically defensible.

2.1 State the Problem

Historical data indicate potential contamination of the Bowmans Pond area as a result of receiving incidental storm water and footing drain effluent from the 700 area for the past 40 years. The most significant data gap for the site is the lack of characterization data for surface soil and subsurface soil. Additionally, the samples available for surface water and sediment data are not representative of current site conditions in the area. The data are not sufficient to characterize the extent or magnitude of the contamination at the site; therefore, future decisions regarding the disposition of Bowmans Pond and IHSS 139.1 (N) area (e.g., accelerated action, interim action, no further action) cannot be made.

2.2 Identify the Decision

Sample data collected by this effort will be used to:

- Identify contaminants of concern (COCs)
- Characterize the extent or magnitude of contamination in surface water, sediment (surface soil), and subsurface soil (i.e. PCOCs) with respect to Tier 1 and/or Tier II action levels.
- Disposition the Bowmans pond and IHSS 139.1(N) site(s) for either further action warranted or propose as No Further Action per RFCA and HRR processes.

Actions based on the decision include an evaluation, remedial action, or management action of soils or surface water identified as exceeding Tier I action levels or the Segment 5 Point of Evaluation (POE) action levels for surface water. Actions based on the decision may also include

an evaluation or management action of soils or surface water identified as not equal to or exceeding Tier I action levels but exceeding Tier II action levels or the Segment 5 Point of Evaluation (POE) for surface water. Actions based on the decision may also include an evaluation or management action of soils or surface water identified as less than Tier II action levels or the Segment 5 Point of Evaluation (POE) for surface water.

2.3 Identify Inputs to the Decision

Inputs to the decision include:

- The concentration of analytical data obtained from surface water, sediment, surface soil, and subsurface soil samples with respect to analysis for PCBs, total metals, VOCs (subsurface only), SVOCs, and isotopic radionuclides. Samples for pH will be collected from surface soil adjacent to the steam condensate tanks.
- RFCA Action Levels

To identify the contaminants of concern for the site, surface soil and sediment concentrations will be compared to the Tier I and Tier II surface soil action levels established under RFCA guidance. Subsurface soil concentrations will be compared to the Tier I subsurface action levels and surface water concentrations will be compared to the action levels from the nearest Point of Evaluation, Segment 5 (RFCA). Methods with quantitation limits (organics) and minimum detectable activities (MDAs) below action level thresholds were selected.

Appendix A provides low-range quantitation limits for PCOCs suspected to be present within the Investigation Area. *It is understood that Tier I action levels for subsurface VOCs may be revised and Tier II action levels may be established on the basis of ongoing negotiations to lower subsurface soil action levels and protect surface waters.*

2.4 Define the Investigation Boundaries

The investigation boundaries are illustrated in Figures 1.2 and 3.1 and are considered representative of the depositional environment for the Building 700 area effluent. The boundary encompassing both Bowmans Pond and IHSS 139.1(N) may be modified if preliminary data warrant such action.

2.5 Develop a Decision Rule

2.5.1 Surface Water

Decision rules for surface water are as follows:

- If concentrations of individual VOCs, metals, PCBs, SVOCs or activities of individual radionuclides measured in surface water equal or exceed Segment 5 POE standards, a management action must be taken.
- If concentrations of individual VOCs, metals, PCBs, SVOCs or activities of individual radionuclides measured in surface water do not equal or exceed Segment 5 POE standards, the surface water will be recommended for NFA.

2.5.2 Sediments and Soils

Decision rules for sediments and soils are as follows:

- If individual radionuclide activities in surface or subsurface soils equal or exceed the RFCA Tier I soil action levels, or the sum of their respective ratios exceed 1, an evaluation, remedial action, or management action is required.
- If individual radionuclide activities are: (1) below the Tier I soil action levels; (2) equal or exceed Tier II soil action levels; (3) the sum of ratios is less than 1 for Tier II values; or (4) below other action levels identified as being protective of surface water, the soils will not require an accelerated action and will be addressed under the Industrial Area CAD/ROD.
- If individual radionuclide activities are below the Tier II soil action levels, or the sum of ratios is less than 1 for Tier II values, or below other action levels identified as being protective of surface water, the soils will be recommended for NFA.
- If the concentration of metals, PCBs, and SVOCs in soils equals or exceeds the RFCA Tier I soil action levels for soils, an action must be taken.
- If the concentration of metals, PCBs, and SVOCs are below the Tier I soil action levels, but equal or exceed Tier II soil action levels, the soils will not require an accelerated action and will be addressed under the Industrial Area CAD/ROD.
- If the concentrations of VOCs in soils equals or exceeds the RFCA Tier I soil action levels for subsurface soils, an action must be taken.
- If preliminary data are observed to exceed the above mentioned action levels and it can be demonstrated that the exceedance is not due to laboratory contamination, the investigation boundaries may be expanded by a distance of 25 feet downgradient to further delineate the extent of migration.

2.6 Specify Limits on Decision Errors

Subjective and judgmental sampling plan is designed to delineate the nature and extent of contamination based on source terms of the effected media as previously described.

2.7 Optimization of Design

Eleven surface soil/sediment and subsurface sample collection locations are spatially located to adequately characterize the investigation area. Sample collection locations have been randomly selected on the basis of: 1) influent areas, 2) center of the pond, 3) effluent area, and 4) depositional areas located down gradient of the pond. Two surface water sampling events will be performed to compare water quality parameters with previous water quality parameters. One surface water sampling event will be performed during normal base level conditions and a second surface water sampling event will be performed during a storm water runoff event. If data gaps are identified as the investigation progresses or subsequent to the collection of all samples as described, this SAP will be modified and additional samples will be collected as needed to adequately characterize the investigation area. Analytical data collected in support of this SAP will be evaluated using the guidance established in Evaluation of Data for Usability in Final Reports (RF/RMRS-98-200).

3.0 SAMPLING ACTIVITIES AND METHODOLOGY

Potential contamination of the investigation area will be evaluated using soil corings of pond sediment, and surface water sampling techniques.

3.1 Soil Borings and Pond Sediment Sampling

Locations for collection of surface soil and subsurface soil were subjectively selected as described in Section 2.7. Sampling for surface soil (from 0.0 to 0.6-ft) and subsurface soil (from greater than 0.6-ft) will be conducted at 11 locations in the investigation area (Figure 3.1). Sampling methodology will consist of hand held soil corings to a depth of approximately 3.0 to 4.0-ft or until native colluvial material is encountered as determined in the field. Soil cores will be collected using a hand held, zero contamination, driver corer as described in procedure SW.17, Pond and Reservoir Bottom Sediment Sampling. Table 3.1 presents the number of coreholes/sampling events, real investigative samples, and quality control samples to be collected during this investigation. Table 3.2 summarizes the analytical program for the investigation. Several attempts at the same location may be required to fulfill the sample volume requirements.

Approximate sample intervals (ft) are as follow:

- 0.0 - 0.6, Composite sample for metals, SVOCs, pesticides/PCBs, tritium, rad screen and radionuclides. Sample for pH at the two coreholes adjacent to the two steam condensate tanks.
- 0.6 – 1.5, Composite sample for metals, SVOCs, pesticides/PCBs, tritium, rad screen and radionuclides.
- 1.5 – 2.0, Grab sample for VOCs.
- 2.0 – 3.5, Composite sample for metals, SVOCs, pesticides/PCBs, tritium, rad screen and radionuclides.
- 3.5 – 4.0, Grab sample for VOCs.

Table 3.1 Field Program

Media	Number of Boreholes/Events	REAL Samples	Duplicate Samples	Rinse Samples	Trip Blanks (VOC only)	Total Samples
Sediment/ Surface Soil	11	11	1	1	1	14
Subsurface Soil	11	22	2	2	2	28
Surface Water	2	2	1	0	1	4

Note: Approximately 39 samples will be collected for radiological screening analysis for Department of Transportation shipping requirements.

Radiological screening samples will be collected surficially and at depth (Table 3.1) to characterize the material for DOT shipping purposes. Samples for pH will also be collected from two sample locations immediately north of the steam condensate tanks. A total of four pH samples (2 from each location) will be collected from composite intervals 0.6 to 1.5 and 2.0 to 3.5 ft. Sample coreholes will be logged according to procedure RMRS/OPS-PRO.101, Logging Alluvial and Bedrock Material. Coreholes will be abandoned by procedure RMRS/OPS-PRO.117, Plugging and Abandonment of Boreholes, except that coreholes will be backfilled with powdered or granular bentonite. Sampling locations will be identified with a unique location number and surveyed for location and elevation using GPS receivers or equivalent equipment.

3.2 Surface Water Sampling

Two surface water-sampling events are proposed to characterize surface water in Bowmans Pond, one during normal base level conditions and a second during a storm water runoff event. Surface water samples will be collected as described in procedure RMRS/OPS-PRO.085, Pond Sampling (Section 5.4.2.2) for Small Pond Sampling from Shore. Surface water field parameters

Table 3.2 Analytical Program

Media	Analytical Method	Analytes	Container	Preservative	Holding Time
Surface Soil, Subsurface Soil, Surface Water	DOT Radiological Screen	Gross Alpha/Gross Beta	60 or 125-ml wide mouth glass or poly jar for soil, 40-ml glass for water.	None	6 months
Surface Soil, Subsurface Soil, Surface Water	Metals	TAL Metals, total	125-ml wide mouth glass jar for soil. 1 x 1-L poly for water.	HNO ₃ pH < 2 for water Cool, 4° C	6 months
Surface Water	Metals	TAL Metals, dissolved	1 x 1-L poly.	HNO ₃ pH < 2 for water	6 months
Surface Water	Oil and Grease	Oil and Grease	1-L glass with Teflon liner.	H ₂ SO ₄ pH < 2, Cool, 4° C	28 days
Surface Water	Radiological	Radionuclides, total	1 x 4-L poly.	HNO ₃ for water	6 months
Surface Water	Radiological	Radionuclides, dissolved	1 x 4-L poly.	HNO ₃ for water	6 months
Surface Water	Nitrate + nitrite as N	Nitrate/Nitrite	250-ml poly or glass.	Cool, 4° C	48 hr
Surface Soil, Subsurface Soil, Surface Water	Extractable Organics	Semivolatile Organic Compounds	125-ml wide mouth glass jar, Teflon lined closure for soil. 3 x 1-L amber glass for water.	Cool, 4° C	7 days for water, 14 days for soil until ext., and 40 days after for both
Surface Soil, Subsurface Soil, Surface Water	Pesticides and PCBs	Pesticides/Aroclors (PCBs)	125-ml wide mouth glass jar, Teflon lined closure for soil. 2 x 1-L amber glass for water.	Cool, 4° C	7 days for water, 14 days for soil until ext., and 40 days after for both
Surface Soil, Subsurface Soil, Surface Water	Tritium	Tritium	500-ml wide mouth glass for soil. 125-ml glass for water.	None	None
Surface Soil, Subsurface Soil	Alpha Spectroscopy	Plutonium-239/240, Americium-241, Uranium Isotopes	125-ml wide mouth glass or poly jar for soil, 1 x 4L poly for water.	None for soil, HNO ₃ for water	6 months
Subsurface Soil, Surface Water	SW-846 Method 8260A	Volatile Organic Compounds	120-ml capped core, 60 or 125-ml wide mouth glass jar, Teflon lined closure for soil. 3 x 40-ml glass, Teflon lined septa cap for water.	Cool, 4° C	14 days

SW-846 (EPA, 1986), Test Methods for Evaluating Solid Waste. RMRS/OPS-PRO.069; Containing, Preserving, Handling, and Shipping soil and Water Samples.

will be collected as described in procedure RMRS/OPS-PRO.081, Surface Water Sampling and recorded per procedure RMRS/OPS-PRO.126, Surface Water Data Collection Activities. Refer to Table 3.1 for the number of sampling events, real investigative samples, and quality control samples to be collected and Table 3.2 for the surface water analytical program.

3.3 Sample Handling

The location and depth interval of surface and subsurface media, either soil or water, recovered during the course of this investigation will be recorded in the field log book. Surface water samples will be recorded on the Soil and Water Database SWDF_1100 Field Data Form. Location codes will be cross-indexed to appropriate sample location designations in the field logbook. Soil core and other material that is subject to only field screening will be identified by the sample location code and depth interval where the sample is obtained. Analytical samples will have Kaiser Hill-Analytical Services Division (KH-ASD) sample numbers and labels applied to the container in the field. A sample correlation form was prepared (Appendix B), to facilitate the documentation and correlation of the type of sample analysis, quality control samples, and radiological screening samples. A block of location codes will be of sufficient size to include the entire number of possible locations scheduled and an additional twenty percent for potential additional locations. The KH-ASD database system (AST) will be used to manage the analytical data from the laboratories, which in turn will be accessed by the RMRS Soil and Water Database (SWD) for management and archival. Sample collection and handling will follow procedure RMRS/OPS-PRO.069, Containing, Preserving, Handling, and Shipping Soil and Water Samples. Radioactive samples (equal to or greater than 2 nCi/g) will be transported to offsite laboratories in accordance with hazardous materials transportation shipping requirements (49CFR 172, 172.101, 173.403, and 173.421) with the appropriate shipping memo.

3.4 Equipment Decontamination/Waste Handling

Reusable sampling equipment will be decontaminated in accordance with procedure FO.03, Field Decontamination Procedures. Decontamination waters generated during the project will be managed according to procedure RMRS/OPS-PRO.112, Handling of Decontamination Water and Wash Water with the exception that the water will be transferred directly to the Consolidated Water Treatment Facility.

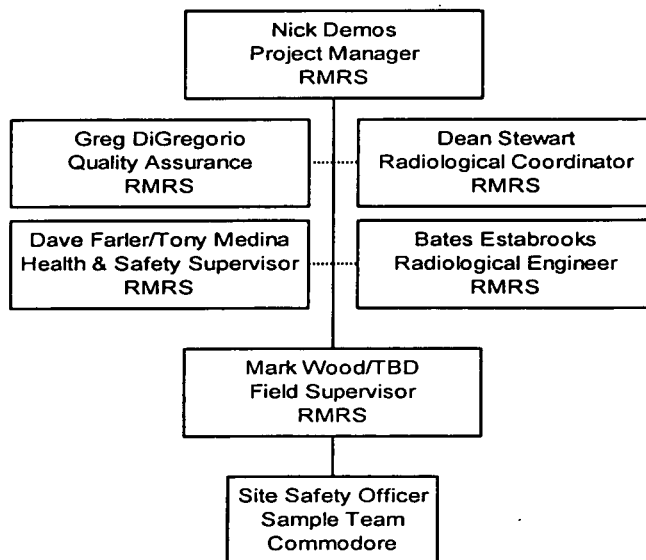
Residual soil will be handled in accordance with RMRS/OPS-PRO.128, Handling and Containerizing Drilling Fluids and Cuttings. Returned sample media will be managed in accordance with 1-PRO-079-WGI-001, "Waste Characterization, Generation, and Packaging. In the event that hazardous, low level, or mixed wastes are generated, project waste generators will

generate, package, and manage the waste containers in accordance with plant procedures (1-C88-WP1027-NONRAD, "Non-Radioactive Waste Packaging"; 1-M12-WO4034, "Radioactive Waste Packaging Requirements"; 4-099-WO-1100, "Solid Radioactive Waste Packaging"; 1-C80-WO-1102-WRT, "Waste/Residue Traveler Instructions"; 1-PRO-079-WGI-001, "Waste Characterization, Generation, and Packaging; and the WSRIC for Operable Unit Operations, "Version 6.0, Section No. 1, PADC-96-00003).

4.0 PROJECT ORGANIZATION

Figure 4.1 illustrates the project organizational structure. The RMRS Characterization Projects Group project manager will be the primary point of responsibility for maintaining data collection and management methods that are consistent with site operations. Other organizations assisting with the implementation of this project are: RMRS Health and Safety, RMRS Quality Assurance, RMRS Radiological Engineering, RMRS Radiological Operations, Commodore Advanced Sciences, Inc., and KH-ASD.

Figure 4.1
Bowmans Pond Characterization Project
Organizational Chart



The sampling personnel will be responsible for field data collection, documentation, and transfer of samples for analysis. Field data collections will include sampling and obtaining screening results. Documentation will require detailed field logs and completing appropriate forms for data management and chain-of-custody shipment. The RMRS project manager will coordinate sample shipment for on-site and off-site analyses through the ASD personnel. The sampling manager is

responsible for verifying that chain-of-custody documents are complete and accurate before the samples are shipped to the analytical laboratories.

5.0 QUALITY ASSURANCE

All components and processes within this project will comply with the RMRS Quality Assurance Program Description RMRS-QAPD-001, rev. 2, 4/15/98 (RMRS, 1998) which is consistent with the K-H Team QA Program (K-H, 1997). The RMRS QA Program is consistent with quality requirements and guidelines mandated by the EPA, CDPHE and DOE. In general, the applicable categories of quality control are as follows: Quality Program, Training, Quality Improvement, Documents and Records, Work Processes, Design, Procurement, Inspection/Acceptance Testing, Management Assessments, and Independent Assessments.

The project manager will be in direct contact with QA to identify and correct issues that potentially affect quality. Field sampling quality control will be conducted to ensure that data generated from all samples collected in the field for laboratory analysis represents the actual conditions in the field. The confidence levels of the data will be maintained as described in Section 2.0 by the collection of QC and duplicate samples, equipment rinsate samples, and trip blanks.

The quality control (QC) samples for the project will include a 1 in 20 frequency for duplicate samples and equipment rinsates. Duplicate samples will be collected on a frequency of one duplicate sample for every twenty real samples. Rinsate samples will be generated at a frequency of one rinsate sample for every 20 real samples collected. Trip blanks will be generated at a frequency of one trip blank for every 20 real VOC samples and detections not associated with a trip blank will be considered real.

Data validation by a third party will be performed on 25% of the laboratory data according to the Rocky Flats ASD, Performance Assurance Group procedures. Samples will be randomly selected from adequate number of sample sets (RINS) by ASD personnel to fulfill data validation of 25% of the total number of analyses. The remaining 75% of the data will be validated and verified. Table 5.1 provides the QA/QC samples and frequency requirements of QA sample generation.

Table 5.1 QA/QC Sample Type, Frequency, and Quantity

Sample Type	Frequency	Comments	Quantity (estimated)
Duplicate	One duplicate for each twenty real samples		4
Rinse Blank	One rinse blank for each twenty real samples	To be performed with reusable sampling equipment following decontamination procedures	3
Trip Blank	One trip blank for each twenty real VOC samples	VOC analyses only	4

Analytical data that is collected in support of the investigation will be evaluated using the guidance developed by Procedure RF/RMRS-98-200, Evaluation of Data for Usability in Final Reports. This procedure establishes the guidelines for evaluating analytical data with respect to precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters.

A definition of PARCC parameters and the specific applications to the investigation are as follows:

Precision - A quantitative measure of data quality that refers to the reproducibility or degree of agreement among replicate or duplicate measurements of a parameter. The closer the numerical values of the measurements are to each other, the lower the relative percent difference and the greater the precision. The relative percent difference (RPD) for results of duplicate and replicate samples will be tabulated according to matrix and analytical suites to compare for compliance with established precision DQOs. Specifications on repeatability are provided in Table 5.2. Deficiencies will be noted and qualified, if required. RPD goals for soils will be 40% for soils and 30% for water. The duplicated error ratio for radionuclides will be 1.96. Radiological precision is determined by comparing the total propagated uncertainty (TPU) of the real versus duplicate, if the result is less than 1.96 then it is acceptable.

Accuracy- A quantitative measure of data quality that refers to the degree of difference between measured or calculated values and the true value of a parameter. The closer the measurement to the true value, the more accurate the measurement. The actual analytical method and detection limits will be compared with the required analytical method and detection limits for VOCs and radionuclides to assess the DQO compliance for accuracy. Sensitivities of analytical methods scheduled are listed in Appendix A.

Representativeness - A qualitative characteristic of data quality defined by the degree to which the data absolutely and exactly represent the characteristics of a population. Representativeness is accomplished by obtaining an adequate number of samples from appropriate spatial locations within the medium of interest. The actual sample types and quantities will be compared with those stated in the SAP or other related documents and organized by media type and analytical suite. Deviation from the required and actual parameters will be justified.

Completeness - A quantitative measure of data quality expressed as the percentage of valid or acceptable data obtained from a measurement system. A completeness goal of 90% has been set for this SAP. The completion goal means that 90% of the data

collected, analyzed, and verified will be of acceptable quality for decision making. Real samples and QC samples will be reviewed for the data usability and achievement of internal DQO usability goals. If sample data cannot be used, the non-compliance will be justified, as required.

Comparability - A qualitative measure defined by the confidence with which one data set can be compared to another. Comparability will be attained through consistent use of industry standards (e.g., SW-846) and standard operating procedures, both in the field and in laboratories. Statistical tests may be used for quantitative comparison between sample sets (populations). Deficiencies will be qualified, as required. Quantitative values for PARCC parameters for the project are provided in Table 5.2.

Table 5.2 PARCC Parameter Summary

PARCC	Radionuclides	Non-Radionuclides
Precision	Duplicate Error Ratio ≤ 1.96	RPD $\leq 30\%$ for Water RPD $\leq 40\%$ for Soil
Accuracy	Detection Limits per method and APO Laboratory SOW. HPGe Detection limits per Technical Basis Document and per SAP	Comparison of Laboratory Control Sample Results with Real Sample Results
Representativeness	Based on SOPs and SAP	Based on SOPs and SAP
Comparability	Based on SOPs and SAP	Based on SOPs and SAP
Completeness	90% Useable	90% Useable

6.0 SCHEDULE

The readiness assessment checklist for the project and the task-specific Health and Safety Plan will be completed prior to commencing field activities. Field activities are expected to begin in March and completed by May 1999. A data summary report will be completed by July 1999.

7.0 REFERENCES

- EG&G, 1991. Assessment of Known, Suspect, and Potential Environmental Releases of Polychlorinated Biphenyls (PCBs), Preliminary Assessment/Site Description, Rocky Flats Plant, Golden, CO., October.
- EG&G, 1992. Historical Release Report, Rocky Flats Plant, Golden, CO., January
- EG&G, 1994. Draft Final Investigations of Foundation Drains and Other Data Compilation, Addendum to the Operable Unit 8 Work Plan, 700 Area, Technical Memorandum No. 1, Rocky Flats Environmental Technology Site, Golden, CO., November.
- EG&G, 1995. Draft Final Operable Unit 8 Data Summary, Technical Memorandum No. 2, Rocky Flats Environmental Technology Site, Golden, CO., September.

Environmental Protection Agency (EPA), 1986. Test Methods for Evaluating Solid Waste. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response, Washington, DC 20460.

Department of Energy (DOE), 1996. Final Rocky Flats Cleanup Agreement, U.S. Department of Energy, Rocky Flats Environmental Technology Site, Golden, CO., July.

Kaiser-Hill, 1997. Kaiser-Hill Team Quality Assurance Program, Rev. 4., Rocky Flats Environmental Technology Site, Golden, CO., August 1.

Rocky Mountain Remediation Services, 1998. Environmental Restoration Ranking, Rocky Flats Environmental Technology Site, Golden, CO., September.

Rocky Mountain Remediation Services, 1998. Site Wide Quality Assurance Program Description, Rocky Flats Environmental Technology Site, Golden, CO.

APPENDIX A
REQUIRED DETECTION LIMITS

INORGANIC METALS
REQUIRED DETECTION LIMITS

Line Item Code Matrix Units		SS05B006	SS05B012	SS05B044
		Aqueous, Unfiltered	Aqueous, Filtered	Solid Total
		µg/L	µg/L	mg/Kg
CAS No.	Element	RDL	RDL	RDL
7429-90-5	Aluminum	200	200	40
7440-36-0	Antimony	60	60	12
7440-38-2	Arsenic	50	50	10
7440-39-3	Barium	100	100	20
7440-41-7	Beryllium	0.8	0.8	0.2
7440-43-9	Cadmium	5	5	1
7440-70-2	Calcium	5000	5000	1000
7440-47-3	Chromium	10	10	2
7440-48-4	Cobalt	50	50	10
7440-50-8	Copper	25	25	5
7439-89-6	Iron	100	100	20
7439-92-1	Lead	50	50	10
7439-93-2	Lithium	100	100	20
7439-95-4	Magnesium	5000	5000	1000
7439-96-5	Manganese	15	15	3
7439-97-6	Mercury ⁽²⁾	0.10	0.10	0.20
7439-98-7	Molybdenum	200	200	40
7440-02-0	Nickel	40	40	8
7440-09-7	Potassium	5000	5000	1000
7782-49-2	Selenium	80	80	16
7440-22-4	Silver	5	5	1
7440-23-5	Sodium	5000	5000	1000
7440-24-6	Strontium	200	200	40
7440-28-0	Thallium	40	40	8
7440-31-5	Tin	200	200	40
11-09-6	Uranium	200	200	40
7440-62-2	Vanadium	40	40	8
7440-66-6	Zinc	20	20	4

PESTICIDES AND PCBs
ROUTINE SW-846 METHODS

Line Item Code: Approved Method Source: Matrices:		SS03B003	SS03B004
		SW-846 METHOD 8080A/8081	SW-846 METHOD 8080A/8081
		Water	Soil, Sludge, Waste
CAS #	ANALYTE	RDL (ug/L)	RDL (ug/Kg)
319-84-6	alpha-BHC	0.03	20
319-85-7	beta-BHC	0.06	40
319-86-8	delta-BHC	0.09	60
58-89-9	gamma-BHC (Lindane)	0.04	27
76-44-8	Heptachlor	0.03	20
309-00-2	Aldrin	0.04	27
1024-57-3	Heptachlor epoxide	0.08	54
959-98-8	Endosulfan I	0.02	14
60-57-1	Dieldrin	0.02	14
72-55-9	4,4-DDE	0.04	27
72-20-8	Endrin	0.06	40
33213-65-9	Endosulfan II	0.04	27
72-54-8	4,4-DDD	0.11	75
1031-07-8	Endosulfan sulfate	0.66	450
50-29-3	4,4-DDT	0.12	80
72-43-5	Methoxychlor	1.80	1200
7421-93-4	Endrin aldehyde	0.23	155
12789-03-6	Chlordane (technical)	0.14	95
8001-35-2	Toxaphene	2.5	1700
12674-11-2	Aroclor-1016	0.50	350
11104-28-2	Aroclor-1221	0.50	350
11141-16-5	Aroclor-1232	0.50	350
53469-21-9	Aroclor-1242	0.50	350
12672-29-6	Aroclor-1248	0.50	350
11097-69-1	Aroclor-1254	0.50	350
11096-82-5	Aroclor-1260	0.50	350

**RADIONUCLIDE TARGET ANALYTE LISTS AND REQUIRED DETECTION LIMITS (RDL)
AMERICIUM, PLUTONIUM, AND URANIUM**

	Line Item Code:	RC01B001	RC01B002	RC01B003
	Matrices:	Water	Water <i>Blank Corrected</i>	Soil
	Reporting Units:	(pCi/l)	(pCi/l)	(pCi/g)
CAS No.	Isotope	RDL	RDL	RDL
14596-10-2	241- Am	0.03	0.03	0.3
10-12-8	239/240 Pu	0.03	0.03	0.3
11-08-5	233/234 - U	1.0	1.0	1.0
15117-96-1	235 - U	1.0	1.0	1.0
7440-61-1	238 - U	1.0	1.0	1.0

Module RC01-B.3

Isotopic Determinations by Alpha Spectrometry April 24, 1998 C-2

TRITIUM

	Line Item Code:	RC02B001	RC02B002
	Matrices:	Water	Soil
	Reporting Units:	(pCi/l)	(pCi/g)
CAS No.	Isotope	RDL	RDL
10028-17-8	Tritium	400	400

Module RC02-B.1

Tritium Analysis by LSC

SEMIVOLATILE ORGANICS TARGET COMPOUND LIST (TCL) AND REQUIRED DETECTION LIMIT

1. SEMIVOLATILE ORGANICS ANALYTE/REQUIREMENTS LISTS

The analyte lists which follow specify required analytes, required method sources, and required detection limits (RDLs).

TABLE C1 ROUTINE CLP METHODS

Line Item Code: Approved Method Source ⁽²⁾ : Matrices:		SS02B001	SS02B002
		CLP-SOW	CLP-SOW Soil Method
		Water, Waste Water,	Soil, Sediment
CAS #	ANALYTE	RDL ⁽¹⁾ (ug/L)	RDL ⁽¹⁾ (ug/kg)
108-95-27	Phenol	10	330
111-44-4	bis(2-Chloroethyl) ether	10	330
95-57-8	2-Chlorophenol	10	330
541-73-1	1,3-Dichlorobenzene	10	330
106-46-7	1,4-Dichlorobenzene	10	330
95-50-1	1,2-Dichlorobenzene	10	330
95-48-7	2-Methylphenol	10	330
108-60-1	2,2'-oxybis(1-Chloropropane)*	10	330
106-44-5	4-Methylphenol	10	330
621-64-7	N-Nitroso-di-n-propylamine	10	330
67-72-1	Hexachloroethane	10	330
98-95-3	Nitrobenzene	10	330
78-59-1	Isophorone	10	330
88-75-5	2-Nitrophenol	10	330
105-67-9	2,4-Dimethylphenol	10	330
111-91-1	bis(2-Chloroethoxy) methane	10	330
120-83-2	2,4-Dichlorophenol	10	330
120-82-1	1,2,4-Trichlorobenzene	10	330
91-20-3	Naphthalene	10	330
106-47-8	4-Chloroaniline	10	330
87-68-3	Hexachlorobutadiene	10	330
59-50-7	4-Chloro-3-methylphenol	10	330
91-57-6	2-Methylnaphthalene	10	330
77-47-4	Hexachlorocyclopentadiene	10	330
88-06-2	2,4,6-Trichlorophenol	10	330
95-95-4	2,4,5-Trichlorophenol	50	1600
91-58-7	2-Chloronaphthalene	10	330
88-74-4	2-Nitroaniline	50	1600
131-11-3	Dimethylphthalate	10	330

*Previously known by the name bis(2-Chloroisopropyl) ether.

TABLE C1 ROUTINE CLP METHODS (continued)

Line Item Code: Approved Method Source ⁽²⁾ : Matrices:		SS02B001	SS02B002
		CLP-SOW	CLP-SOW Soil Method
		Water, Waste Water,	Soil, Sediment
CAS #	ANALYTE	RDL ⁽¹⁾ (ug/L)	RDL ⁽¹⁾ (ug/kg)
208-96-8	Acenaphthylene	10	330
606-20-2	2,6-Dinitrotoluene	10	330
99-09-2	3-Nitroaniline	50	1600
83-32-9	Acenaphthene	10	330
51-28-5	2,4-Dinitrophenol	50	1600
100-02-7	4-Nitrophenol	50	1600
132-64-9	Dibenzofuran	10	330
121-14-2	2,4-Dinitrotoluene	10	330
84-66-2	Diethylphthalate	10	330
7005-72-3	4-Chlorophenyl-phenyl ether	10	330
86-73-7	Fluorene	10	330
100-01-6	4-Nitroaniline	50	1600
534-52-1	4,6-Dinitro-2-methylphenol	50	1600
86-30-6	N-nitrosodiphenylamine	10	330
101-55-3	4-Bromophenyl-phenylether	10	330
118-74-1	Hexachlorobenzene	10	330
87-86-5	Pentachlorophenol	50	1600
85-01-8	Phenanthrene	10	330
120-12-7	Anthracene	10	330
86-74-8	Carbazole	10	330
84-74-2	Di-n-butylphthalate	10	330
206-44-0	Fluoranthene	10	330
129-00-0	Pyrene	10	330
85-68-7	Butylbenzylphthalate	10	330
91-94-1	3,3'-Dichlorobenzidine	10	330
56-55-3	Benzo(a)anthracene	10	330
218-01-9	Chrysene	10	330
117-81-7	bis(2-ethylhexyl)phthalate	10	330
117-84-0	Di-n-octylphthalate	10	330
205-99-2	Benzo(b)fluoranthene	10	330
207-08-9	Benzo(k)fluoranthene	10	330
50-32-8	Benzo(a)pyrene	10	330
193-39-5	Indeno(1,2,3-cd)pyrene	10	330
53-70-3	Dibenz(a,h)anthracene	10	330
191-24-2	Benzo(g,h,i)perylene	10	330

TABLE C2 ROUTINE SW-846 METHODS

Line Item Code: Approved Method Source ⁽²⁾ : Matrices:		SS02B008 SW-846 METHOD 8270B Water, Waste Water	SS02B009 SW-846 METHOD 8270B Soil, Sediment, Waste
CAS #	ANALYTE	RDL ⁽¹⁾ (ug/L)	RDL ⁽¹⁾ (ug/ Kg)
108-95-27	Phenol	10	660
110-86-1	Pyridine	10	660
111-44-4	bis(2-Chloroethyl) ether	10	660
95-57-8	2-Chlorophenol	10	660
541-73-1	1,3-Dichlorobenzene	10	660
106-46-7	1,4-Dichlorobenzene	10	660
100-51-6	Benzyl Alcohol	20	1300
95-50-1	1,2-Dichlorobenzene	10	660
95-48-7	2-Methylphenol	10	660
39638-32-9	bis(2-Chloroisopropyl) ether	10	660
106-44-5	4-Methylphenol	10	660
621-64-7	N-Nitroso-di-n-propylamine	10	660
67-72-1	Hexachloroethane	10	660
98-95-3	Nitrobenzene	10	660
78-59-1	Isophorone	10	660
88-75-5	2-Nitrophenol	10	660
105-67-9	2,4-Dimethylphenol	10	660
65-85-0	Benzoic Acid	50	3300
111-91-1	bis(2-Chloroethoxy) methane	10	660
120-83-2	2,4-Dichlorophenol	10	660
120-82-1	1,2,4-Trichlorobenzene	10	660
91-20-3	Naphthalene	10	660
106-47-8	4-Chloroaniline	20	1300
87-68-3	Hexachlorobutadiene	10	660
59-50-7	4-Chloro-3-methylphenol	20	1300
91-57-6	2-Methylnaphthalene	10	660
77-47-4	Hexachlorocyclopentadiene	10	660
88-06-2	2,4,6-Trichlorophenol	10	660
95-95-4	2,4,5-Trichlorophenol	10	660
91-58-7	2-Chloronaphthalene	10	660
88-74-4	2-Nitroaniline	50	3300
131-11-3	Dimethylphthalate	10	660
208-96-8	Acenaphthylene	10	660
99-09-2	3-Nitroaniline	50	3300
83-32-9	Acenaphthene	10	660
51-28-5	2,4-Dinitrophenol	50	3300

TABLE C2 ROUTINE SW-846 METHODS (continued)

Line Item Code: Approved Method Source ⁽²⁾ : Matrices:		SS02B008	SS02B009
		SW-846 METHOD 8270B	SW-846 METHOD 8270B
		Water, Waste Water	Soil, Sediment, Waste
CAS #	ANALYTE	RDL ⁽¹⁾ (ug/L)	RDL ⁽¹⁾ (ug/ Kg)
100-02-7	4-Nitrophenol	50	3300
132-64-9	Dibenzofuran	10	660
121-14-2	2,4-Dinitrotoluene	10	660
606-20-2	2,6-Dinitrotoluene	10	660
84-66-2	Diethylphthalate	10	660
7005-72-3	4-Chlorophenyl-phenyl ether	10	660
86-73-7	Fluorene	10	660
100-01-6	4-Nitroaniline	50	3300
534-52-1	4,6-Dinitro-2-methylphenol	50	3300
86-30-6	N-nitrosodiphenylamine	10	660
101-55-3	4-Bromophenyl-phenylether	10	660
118-74-1	Hexachlorobenzene	10	660
87-86-5	Pentachlorophenol	50	3300
85-01-8	Phenanthrene	10	660
120-12-7	Anthracene	10	660
84-74-2	Di-n-butylphthalate	10	660
206-44-0	Fluoranthene	10	660
129-00-0	Pyrene	10	660
85-68-7	Butylbenzylphthalate	10	660
91-94-1	3,3'-Dichlorobenzidine	20	1300
56-55-3	Benzo(a)anthracene	10	660
117-81-7	bis(2-ethylhexyl)phthalate	10	660
218-01-9	Chrysene	10	660
117-84-0	Di-n-octylphthalate	10	660
205-99-2	Benzo(b)fluoranthene	10	660
207-08-9	Benzo(k)fluoranthene	10	660
50-32-8	Benzo(a)pyrene	10	660
193-39-5	Indeno(1,2,3-cd)pyrene	10	660
53-70-3	Dibenz(a,h)anthracene	10	660
191-24-2	Benzo(g,h,i)perylene	10	660

TABLE C3 APPENDIX IX SW-846 METHODS

Line Item Code: Approved Method Source ⁽²⁾ : Matrices:		SS02B005	SS02B006
		SW-846 Method 8270B	SW-846 Method 8270B
		Water, Waste Water,	Soil, Sediment, waste
CAS #	ANALYTE	RDL ^(1,3) (ug/L)	RDL ^(1,3) (ug/kg)
83-32-9	Acenaphthene	10	660
208-96-8	Acenaphthylene	10	660
98-86-2	Acetophenone	10	ND
53-96-3	2-Acetylaminofluorene; 2-AAF	20	ND
92-67-1	4-Aminobiphenyl	20	ND
120-12-7	Anthracene	10	660
140-57-8	Aramite	20	ND
56-55-3	Benzo[a]anthracene	10	660
205-99-2	Benzo[b]fluoranthene	10	660
207-08-9	Benzo[k]fluoranthene	10	660
191-24-2	Benzo[ghi]perylene	10	660
50-32-8	Benzo[a]pyrene	10	660
100-51-6	Benzyl alcohol	20	1300
101-55-3	4-Bromophenyl phenyl ether	10	660
85-68-7	Butylbenzylphthalate	10	660
106-47-8	4-Chloroaniline	20	1300
510-15-6	Chlorobenzilate	10	ND
59-50-7	p-Chloro-m-cresol	20	1300
91-58-7	2-Chloronaphthalene	10	660
95-57-8	2-Chlorophenol	10	660
7005-72-3	4-Chlorophenyl phenyl ether	10	660
218-01-9	Chrysene	10	660
2303-16-4	Diallate	10	ND
53-70-3	Dibenz[a,h]anthracene	10	660
132-64-9	Dibenzofuran	10	660
84-74-2	Di-n-butyl phthalate	10	ND
95-50-1	o-Dichlorobenzene	10	660
541-73-1	m-Dichlorobenzene	10	660
106-46-7	p-Dichlorobenzene	10	660
91-94-1	3,3'-Dichlorobenzidine	20	1300
120-83-2	2,4-Dichlorophenol	10	660
87-65-0	2,6-Dichlorophenol	10	ND
84-66-2	Diethyl phthalate	10	660
297-97-2	IO,O-Diethyl O-2-pyrazinyl phosphorothioate; Thionazin	ND	ND
60-51-5	Dimethoate	20	ND
60-11-7	p-(Dimethylamino)azobenzene	10	ND

TABLE C3 APPENDIX IX SW-846 METHODS (continued)

Line Item Code: Approved Method Source ⁽²⁾ : Matrices:		SS02B005 SW-846 Method 8270B Water, Waste Water,	SS02B006 SW-846 Method 8270B Soil, Sediment, waste
CAS #	ANALYTE	RDL ^(1,3) (ug/L)	RDL ^(1,3) (ug/kg)
57-97-6	7,12-Dimethylbenz[a]anthracene	10	ND
119-93-7	3,3'-Dimethylbenzidine	10	ND
122-09-8	alpha, alpha-Dimethylphenethylamine	ND	ND
105-67-9	2,4-Dimethylphenol	10	660
131-11-3	Dimethyl phthalate	10	660
99-65-0	m-Dinitrobenzene	20	ND
534-52-1	4,6-Dinitro-o-cresol	50	3300
51-28-5	2,4-Dinitrophenol	50	3300
121-14-2	2,4-Dinitrotoluene	10	660
50606-20-2	2,6-Dinitrotoluene	10	660
117-84-0	Di-n-octyl phthalate	10	660
122-39-4	Diphenylamine	50	ND
298-04-4	Disulfoton	10	ND
62-50-0	Ethyl methanesulfonate	20	ND
52-85-7	Famphur	20	ND
206-44-0	Fluoranthene	10	660
86-73-7	Fluorene	10	660
118-74-1	Hexachlorobenzene	10	660
87-68-3	Hexachlorobutadiene	10	660
77-47-4	Hexachlorocyclopentadiene	10	660
67-72-1	Hexachloroethane	10	660
70-30-4	Hexachlorophene	50	ND
1888-71-7	Hexachloropropene	10	ND
193-39-5	Indeno(1,2,3-cd)pyrene	10	660
465-73-6	Isodrin	20	ND
78-59-1	Isophorone	10	660
120-58-1	Isosafrole	10	ND
143-50-0	Kepone	20	ND
91-80-5	Methapyrilene	100	ND
56-49-5	3-Methylcholanthrene	10	ND
66-27-3	Methyl methanesulfonate	10	ND
91-57-6	2-Methylnaphthalene	10	660
298-00-0	Methyl parathion; Parathion methyl	10	ND
91-20-3	Naphthalene	10	660
130-15-4	1,4-Naphthoquinone	10	ND
134-32-7	1-Naphthylamine	10	ND

TABLE C3 APPENDIX IX SW-846 METHODS (continued)

Line Item Code: Approved Method Source ⁽²⁾ Matrices:		SS02B005	SS02B006
		SW-846 Method 8270B	SW-846 Method 8270B
		Water, Waste Water,	Soil, Sediment, waste
CAS #	ANALYTE	RDL ^(1,3) (ug/L)	RDL ^(1,3) (ug/kg)
91-59-8	2-Naphthylamine	10	ND
88-74-4	o-Nitroaniline	50	3300
99-09-2	m-Nitroaniline	50	3300
100-01-6	p-Nitroaniline	50	ND
98-95-3	Nitrobenzene	10	660
88-75-5	o-Nitrophenol	10	660
100-02-7	p-Nitrophenol	50	3300
56-57-5	4-Nitroquinoline 1-oxide	40	ND
924-16-3	N-Nitrosodi-n-butylamine	10	ND
55-18-5	N-Nitrosodiethylamine	20	ND
62-75-9	N-Nitrosodimethylamine	ND	ND
86-30-6	N-Nitrosodiphenylamine	10	660
621-64-7	N-Nitrosodipropylamine; Di-n-propylnitrosamine	10	660
10595-95-6	N-Nitrosomethylethylamine	ND	ND
59-89-2	N-Nitrosomorpholine	ND	ND
100-75-4	N-Nitrosopiperidine	20	ND
930-55-2	N-Nitrosopyrrolidine	40	ND
99-55-8	5-Nitro-o-toluidine	10	ND
56-38-2	Parathion	10	ND
608-93-5	Pentachlorobenzene	10	ND
82-68-8	Pentachloronitrobenzene	20	ND
87-86-5	Pentachlorophenol	50	3300
62-44-2	Phenacetin	20	ND
85-01-8	Phenanthrene	10	660
108-95-2	Phenol	10	660
106-50-3	p-Phenylenediamine	10	ND
298-02-2	Phorate	10	ND
109-06-8	2-Picoline	ND	ND
23950-58-5	Pronamide	10	ND
129-00-0	Pyrene	10	660
94-59-7	Safrole	10	ND
95-94-3	1,2,4,5-Tetrachlorobenzene	10	ND
58-90-2	2,3,4,6-Tetrachlorophenol	10	ND
3689-24-5	Tetraethyl dithiopyrophosphate; Sulfotepp	40	ND
95-53-4	o-Toluidine	10	ND
120-82-1	1,2,4-Trichlorobenzene	10	660

TABLE C3 APPENDIX IX SW-846 METHODS (continued)

Line Item Code: Approved Method Source ⁽²⁾ : Matrices:		SS02B005	SS02B006
		SW-846 Method 8270B	SW-846 Method 8270B
		Water, Waste Water,	Soil, Sediment, waste
CAS #	ANALYTE	RDL ^(1,3) (ug/L)	RDL ^(1,3) (ug/kg)
95-95-4	2,4,5-Trichlorophenol	10	660
88-06-2	2,4,6-Trichlorophenol	10	660
126-68-1	O,O,O-Triethyl phosphorothioate	ND	ND
99-35-4	sym-Trinitrobenzene	10	ND

TABLE C4 TCLP METHODS

Line Item Code: Approved Method Source ⁽²⁾ : Matrices:		SS02B007
		SW-846 Method 8270B
		TCLP extracts
CAS #	ANALYTE	RDL ⁽¹⁾ (ug/L)
110-86-1	Pyridine	50
106-46-7	1,4-Dichlorobenzene	50
95-48-7	2-Methylphenol	50
108-39-4	3-Methylphenol	50
106-44-5	4-Methylphenol	50
67-72-1	Hexachloroethane	50
98-95-3	Nitrobenzene	50
88-06-2	2,4,6-Trichlorophenol	50
95-95-4	2,4,5-Trichlorophenol	250
121-14-2	2,4-Dinitrotoluene	50
118-74-1	Hexachlorobenzene	50
87-86-5	Pentachlorophenol	250
87-68-3	Hexachlorobutadiene	50

- (1) The RDLs are the required detection limits.
- (2) It is the responsibility of the Laboratory to assure that the method is appropriate to the sample matrix and to use the most recently promulgated version of the specified method source.
- (3) ND means achievable RDL's have not been determined.

VOLATILE ORGANICS TARGET COMPOUND LIST (TCL) AND REQUIRED DETECTION LIMIT

1. VOLATILE ORGANICS ANALYTE/REQUIREMENTS LISTS

The analyte lists which follow specify required analytes, the approved method source, and required detection limits (RDLs).

TABLE C1 ROUTINE CLP METHODS

Line Item Code: Approved Method Source ⁽²⁾ : Matrices:		SS01B001 CLP-SOW Water, Waste Water,	SS01B002 CLP-SOW (Low Level Soil Method) Soil, Sediment	SS01B003 CLP-SOW (Medium Level Soil Method) Soil, Sediment
CAS #	ANALYTE	RDL ⁽¹⁾ (ug/L)	RDL ⁽¹⁾ (ug/kg)	RDL ⁽¹⁾ (ug/kg)
74-87-3	Chloromethane	10	10	1200
74-83-9	Bromomethane	10	10	1200
75-01-4	Vinyl Chloride	10	10	1200
75-00-3	Chloroethane	10	10	1200
75-09-2	Methylene Chloride	10	10	1200
67-64-1	Acetone	10	10	1200
75-15-0	Carbon Disulfide	10	10	1200
75-35-4	1,1-Dichloroethene	10	10	1200
75-34-3	1,1-Dichloroethane	10	10	1200
540-59-0	1,2-Dichloroethene (total)	10	10	1200
67-66-3	Chloroform	10	10	1200
107-06-2	1,2-Dichloroethane	10	10	1200
78-93-3	2-Butanone	10	10	1200
71-55-6	1,1,1-Trichloroethane	10	10	1200
56-23-5	Carbon Tetrachloride	10	10	1200
75-27-4	Bromodichloromethane	10	10	1200
78-87-5	1,2-Dichloropropane	10	10	1200
10061-01-5	cis-1,3-Dichloropropene	10	10	1200
79-01-6	Trichloroethene	10	10	1200
124-48-1	Dibromochloromethane	10	10	1200
79-00-5	1,1,2-Trichloroethane	10	10	1200
71-43-2	Benzene	10	10	1200
10061-02-6	trans-1,3-Dichloropropene	10	10	1200
75-25-2	Bromoform	10	10	1200
108-10-1	4-Methyl-2-pentanone	10	10	1200
591-78-6	2-Hexanone	10	10	1200
127-18-4	Tetrachloroethene	10	10	1200
108-88-3	Toluene	10	10	1200
79-34-5	1,1,2,2-Tetrachloroethane	10	10	1200
108-90-7	Chlorobenzene	10	10	1200
100-41-4	Ethyl Benzene	10	10	1200
100-42-5	Styrene	10	10	1200
1330-20-7	Xylenes (Total)	10	10	1200

TABLE C2 ROUTINE SW-846 METHODS

Line Item Code:		SS01B004	SS01B005	SS01B006	SS01B010
Approved Method Source ⁽²⁾ :		SW-846 METHOD 8260 (Low Level)	SW-846 METHOD 8260	SW-846 METHOD 8260	Routine 24 Hour ⁽⁴⁾ SW-846 METHOD 8260 (Medium Level Soil Method)
Matrices:		Water, Waste Water	Water, Aqueous Waste	Soil, Sediment, Waste	Soil, Sediment
CAS #	ANALYTE	RDL ⁽¹⁾ (ug/L)	RDL ⁽¹⁾ (ug/L)	RDL ⁽¹⁾ (ug/kg)	RDL ⁽¹⁾ (ug/kg)
75-71-8	Dichlorodifluoromethane	1	5	5	1200
74-87-3	Chloromethane	1	5	5	1200
74-83-9	Bromomethane	1	5	5	1200
75-01-4	Vinyl Chloride	1	5	5	1200
75-00-3	Chloroethane	1	5	5	600
75-69-4	Trichlorofluoromethane	1	5	5	600
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1	5	5	600
75-09-2	Methylene Chloride	1	5	5	600
67-64-1	Acetone	10	100	100	1200
75-15-0	Carbon Disulfide	1	5	5	600
75-35-4	1,1-Dichloroethene	1	5	5	600
75-34-3	1,1-Dichloroethane	1	5	5	600
156-60-5	trans-1,2-Dichloroethene	1	5	5	600
594-20-7	2,2-Dichloropropane	1	5	5	600
156-59-2	cis-1,2-Dichloroethene	1	5	5	600
74-97-5	Bromochloromethane	1	5	5	600
67-66-3	Chloroform	1	5	5	600
107-06-2	1,2-Dichloroethane	1	5	5	600
78-93-3	2-Butanone	10	100	100	1200
71-55-6	1,1,1-Trichloroethane	1	5	5	600
56-23-5	Carbon Tetrachloride	1	5	5	600
75-27-4	Bromodichloromethane	1	5	5	600
79-34-5	1,1,2,2-Tetrachloroethane	1	5	5	600
78-87-5	1,2-Dichloropropane	1	5	5	600
10061-02-6	trans-1,3-Dichloropropene	1	5	5	600
74-95-3	Dibromomethane	1	5	5	600
79-01-6	Trichloroethene	1	5	5	600
124-48-1	Dibromochloromethane	1	5	5	600
79-00-5	1,1,2-Trichloroethane	1	5	5	600
563-58-6	1,1-Dichloropropene	1	5	5	600
71-43-2	Benzene	1	5	5	600
10061-01-5	cis-1,3-Dichloropropene	1	5	5	600

TABLE C2 ROUTINE SW-846 METHODS (continued)

Line Item Code:		SS01B004	SS01B005	SS01B006	SS01B010
Approved Method Source ⁽²⁾ :		SW-846 METHOD 8260 (Low Level)	SW-846 METHOD 8260	SW-846 METHOD 8260	Routine 24 Hour⁽⁴⁾ SW-846 METHOD 8260 (Medium Level Soil Method)
Matrices:		Water, Waste Water	Water, Aqueous Waste	Soil, Sediment, Waste	Soil, Sediment
CAS #	ANALYTE	RDL ⁽¹⁾ (ug/L)	RDL ⁽¹⁾ (ug/L)	RDL ⁽¹⁾ (ug/kg)	RDL ⁽¹⁾ (ug/kg)
75-25-2	Bromoform	1	5	5	600
591-78-6	2-Hexanone	10	50	50	1200
108-10-1	4-Methyl-2-pentanone	10	50	50	1200
142-28-9	1,3-Dichloropropane	1	5	5	600
127-18-4	Tetrachloroethene	1	5	5	600
108-88-3	Toluene	1	5	5	600
108-90-7	Chlorobenzene	1	5	5	600
100-41-4	Ethylbenzene	1	5	5	600
100-42-5	Styrene	1	5	5	600
1330-20-7	Xylenes (total)	1	5	5	600
630-20-6	1,1,1,2-Tetrachloroethane	1	5	5	600
106-93-4	1,2-Dibromoethane	1	5	5	600
98-82-8	Isopropylbenzene	1	5	5	600
108-86-1	Bromobenzene	1	5	5	600
96-18-4	1,2,3-Trichloropropane	1	5	5	600
103-65-1	n-Propylbenzene	1	5	5	600
95-49-8	2-Chlorotoluene	1	5	5	600
106-43-4	4-Chlorotoluene	1	5	5	600
108-67-8	1,3,5-Trimethylbenzene	1	5	5	600
98-06-6	tert-Butylbenzene	1	5	5	600
95-63-6	1,2,4-Trimethylbenzene	1	5	5	600
135-98-8	sec-Butylbenzene	1	5	5	600
541-73-1	m-Dichlorobenzene	1	5	5	600
99-87-6	4-Isopropyltoluene	1	5	5	600
106-46-7	p-Dichlorobenzene	1	5	5	600
95-50-1	o-Dichlorobenzene	1	5	5	600
104-51-8	n-Butylbenzene	1	5	5	600
96-12-8	1,2-Dibromo-3-chloropropane	1	5	5	600
120-82-1	1,2,4-Trichlorobenzene	1	5	5	600
87-68-3	Hexachlorobutadiene	1	5	5	600
91-20-3	Naphthalene	1	5	5	600
87-61-6	1,2,3-Trichlorobenzene	1	5	5	600

TABLE C8 SW846 METHOD 8015

Line Item Code:		SS01B013	SS01B014
Approved Method Source ⁽²⁾ :		SW-846 METHOD 8015	SW-846 METHOD 8015
Matrices:		Water	Soil, Sludge, Waste
CAS #	ANALYTE	RDL ⁽¹⁾ (ug/L)	RDL ⁽¹⁾ (ug/Kg)
67-56-1	Methanol	25	250

TABLE C9 SW846 METHOD 8260 EXTENDED ANALYTE LIST

Line Item Code:		SS01B015	SS01B016
Approved Method Source ⁽²⁾ :		SW-846 METHOD 8260,	SW-846 METHOD 8260,
Matrices:		Water	Soil, Sludge, Waste
CAS #	ANALYTE	RDL ⁽¹⁾ (ug/L)	RDL ⁽¹⁾ (ug/Kg)
71-36-3	n-Butyl alcohol	50	50
78-83-1	Isobutyl alcohol	50	50
108-94-1	Cyclohexanone	50	50
141-78-6	Ethyl acetate	50	50
60-29-7	Ethyl ether	50	50
CAS Numbers identified in Table C2	All Analytes listed in Table C2	RDLs for Line Item Code SS01*005	RDLs for Line Item Code SS01*006

* denotes current module revision letter

- (1) The RDLs are the required detection limits.
- (2) It is the responsibility of the Laboratory to assure that the method is appropriate to the sample matrix and to use the most recently promulgated version of the specified method source.
- (3) Methods must comply with requirements of SW-846 Method 1311, Zero Headspace Method, for the analysis of volatile organics and with the RDLs listed above.
- (4) The required detection limits range from 0.6 to 1.2 mg/kg of soil. Any non-detects at this level do not require the low level soil method. Any concentrations higher than the analytical curve range shall be reported as estimated and shall be diluted and reanalyzed only at the request of the CTR. Exceptions include blanks and rinsate waters that will be analyzed using the low level method.

See SS01 Exhibit B, Section 2 for delivery schedule.

WATER QUALITY PARAMETERS REQUIREMENTS

1. WATER QUALITY PARAMETERS REQUIREMENTS LISTS

Table C1 and Table C2 specify required parameters, required detection limits (RDLs), required method sources and method type descriptions for each WQP line item code.

2. TABLE C1 AND TABLE C2, WATER QUALITY PARAMETERS

Table C1 WATER QUALITY PARAMETERS

Line Item Codes	Parameter Identifier	Parameter Name	RDL ⁽¹⁾ (mg/L)	Approved Methods ⁽²⁾	Method Type
SS06B001	10-70-8	Acidity	10	EPA 305.1, SM 2310	Titrimetric
SS06B002	T-005	Alkalinity, Total as CaCO ₃	10	EPA 310.1, 310.2, SM 2320 B	Titrimetric (to pH 4.5)
SS06B003	71-52-3	Alkalinity, Bicarbonate (HCO ₃ ⁻) as CaCO ₃	10	EPA 310.1, 310.2, SM 2320 B	Titrimetric
SS06B004	3812-32-6	Alkalinity, Carbonate (CO ₃ ²⁻) as CaCO ₃	10	EPA 310.1, 310.2, SM 2320 B	Titrimetric
SS06B005	7727-37-9	Ammonia as N	0.1	EPA 350.1, SM 4500-NH ₃ H	Colorimetric/Spectrophotometric (Automated-Phenate)
				EPA 350.3, 4500-NH ₃ -F, G,	Potentiometric (Ion Selective Electrode)
SS06B006	10-26-4	Biochemical Oxygen Demand (BOD ₅)	2	HACH GRAPHICAL METHOD	Potentiometric (Dissolved Oxygen Depletion)
SS06B007	24959-67-9	Bromide	2	EPA 300.0	Ion Chromatography
				EPA 320.1	Titrimetric
SS06B008	11-03-0	Carbonaceous Biochemical Oxygen Demand (CBOD ₅)	2	HACH GRAPHICAL METHOD	Potentiometric (Dissolved Oxygen Depletion with Nitrification Inhibitor)
SS06B009	C-004	Chemical Oxygen Demand (COD)	5	EPA 410.4, SM 5220 D	Colorimetric/Spectrophotometric
SS06B010	16887-00-6	Chloride	0.5	EPA 300.0	Ion Chromatography
				EPA 325.3	Titrimetric
SS06B011	18540-29-9	Chromium VI (Hexavalent Cr)	0.02	EPA 218.4, SM3500-Cr D, SW-846 7196 A,	Colorimetric/Spectrophotometric
SS06B012	57-12-5	Cyanide, Total	0.005	EPA 335.3, 335.4, SM4500-CN C, E	Colorimetric/Spectrophotometric (Manual Distillation followed by Analysis)
SS06B013	57-12-5	Cyanide, Total, for RCRA Compliance	0.005	SW-846 9010, 9012	Colorimetric/Spectrophotometric (Manual Distillation followed by Analysis)
SS06B014	10-87-7	Cyanide, Amenable to Chlorination	0.005	EPA 335.1, SM4500-CN G	Colorimetric/Spectrophotometric
SS06B015	10-87-7	Cyanide, Amenable to Chlorination, for RCRA Compliance	0.005	SW-846 9010A & 9012	Colorimetric/Spectrophotometric
SS06B016	Inactive	Inactive	Inactive	Inactive	Inactive

Table C1 WATER QUALITY PARAMETERS (continued)

Line Item Codes	Parameter Identifier	Parameter Name	RDL ⁽¹⁾ (mg/L)	Approved Methods ⁽²⁾	Method Type
SS06B017	10-71-9	Cyanide, Releasable, for RCRA Compliance	0.005	SW-846 Chapter 7, SW-846 9010A, & 9012	Colorimetric/Spectrophotometric (Distillation followed by Analysis)
SS06B018	16984-48-8	Fluoride	0.5	EPA 300.0	Ion Chromatography
				EPA 340.2, SM4500-F B, C	Potentiometric (Distillation followed by ISE)
SS06B019	11-02-9	Hardness as CaCO ₃	10	EPA 130.2, SM 2340C	Titrimetric
SS06B020	14797-55-8	Nitrate as N	0.5	EPA 300.0	Ion Chromatography
				EPA 352.1, EPA 353.1, 353.2,	Colorimetric/Spectrophotometric (Brucine sulfate) (NO ₃ /NO ₂ less.2 NO ₂)
SS06B021	14797-65-0	Nitrite as N	0.5	EPA 300.0	Ion Chromatography
				EPA 354.1, SM4500-NO ₂ ⁻ B, EPA 353.1, 353.2, 4500-NO ₃ ⁻ E, H	Colorimetric/Spectrophotometric (Without reduction)
SS06B022	C-005	Nitrate/Nitrite as N (Total Nitrate/Nitrite as N)	0.05	EPA 353.1, SM4500-NO ₃ ⁻ H, EPA 353.2, 4500-NO ₃ ⁻ E	Colorimetric/Spectrophotometric (Auto Hydrazine) (Cadmium Reduction)
SS06B023	10-30-0	Oil and Grease, Total Recoverable	5	EPA 413.1, EPA 413.2	Gravimetric Extraction
SS06B024	11-59-6	Organic Carbon, Dissolved (DOC)	1.0	EPA 415.1	IR
SS06B025	10-35-5	Organic Carbon, Total (TOC)	1.0	EPA 415.1, SM5310 B, C, D	IR
SS06B026	10-29-7	pH (Hydrogen Ion)	0.1 S.U. at 25°C	EPA 150.1, SM4500-H ⁺ B, SW-846 9040 (water), SW-846 9045A (soil)	Potentiometric
SS06B027	108-95-2	Phenol	0.1	EPA 420.1, SM 5530D	Colorimetric/Spectrophotometric
SS06B028	14265-44-2	Phosphate (ortho) as P (Ortho Phosphate)	0.01	EPA 365.1, .2, .3, SM4500-P F, E	Colorimetric/Spectrophotometric
				EPA 300.0	Ion Chromatography
SS06B029	7723-14-0	Phosphate (total) as P	0.01	EPA 365.1, .2, .3 SM4500-P B,5	Colorimetric/Spectrophotometric (Persulfate digestion followed by OrthoPhosphate Analysis)
SS06B030	See Table C-2	Sediment Analysis, Sand-Silt Split	N/A	ASTM D422 & D4822, USGS ⁽³⁾	Gravimetric
SS06B031	7631-86-9	Silica as SiO ₂ , Dissolved	5	EPA 370.1, SM4500-Si D	Colorimetric/Spectrophotometric
SS06B032	11-06-3	Solids, Non-Volatile Suspended (NVSS), (Non-Filterable Residue at 550°C)	5	EPA 160.4, SM2540 E	Gravimetric (TSS-VSS)
SS06B033	C-008	Solids, Total (TS) (Total Residue at 103°C to 105°C)	10	EPA 160.3, SM2540 B	Gravimetric
SS06B034	10-33-3	Solids, Total Dissolved Solids (TDS), (Filterable Residue at 180°C)	10	EPA 160.1, SM2540 C	Gravimetric

Table C1 WATER QUALITY PARAMETERS (continued)

Line Item Codes	Parameter Identifier	Parameter Name	RDL ⁽¹⁾ (mg/L)	Approved Methods ⁽²⁾	Method Type
SS06B035	10-32-2	Solids, Total Suspended (TSS) (Non-Filterable Residue at 103°C to 105°C)	5	EPA 160.2, SM2540 D	Gravimetric
SS06B036	10-34-4	Specific Conductance (Conductivity)	10 mmho/cm at 25°C	EPA 120.1, SM 2510 B	Potentiometric
SS06B037	14808-79-8	Sulfate as SO ₄ ²⁻	5.0	EPA 375.1, EPA 375.2 SW846-9035 & 9036	Colorimetric/Spectrophotometric
				EPA 300.0	Ion Chromatography
SS06B038	RFS-RS-97	Sulfide as H ₂ S, Releasable, for RCRA Compliance	1	SW846 Chapter 7, SW-846 9030A	Titrimetric (Distillation followed by Analysis)
SS06B039	18496-25-8	Sulfide as S	0.002	EPA 376.1, .2 SM4500-S ²⁻ E ⁽⁴⁾	Colorimetric/Spectrophotometric (Gas Dialysis, Automated Methylene Blue Method)
SS06B040	7727-37-9	Total Kjeldahl Nitrogen (TKN) (Organic Nitrogen as N)	0.2	EPA 351.1, 351.2, 351.3, 351.4 SM4500-NH ₃	Colorimetric/Spectrophotometric (Preparation followed by Ammonia as N)
SS06B041	59473-04-0	Total Organic Halides (TOX)	1.0	SW-846 9020,	TOX
SS06B042	10-90-2	Total Petroleum Hydrocarbons (TPH)	1.0	EPA 418.1, SM 5520 F	IR
SS06B043	10-08-02	Turbidity	1.0 NTU	EPA 180.1, SM2130 B	Turbidimetric (Nephelometric)

- (1) RDLs (Required Detection Limits) listed in Table C1 specify maximum allowed levels for MDLs. See SS06 Exhibit D Section 11.
- (2) It is the responsibility of the Laboratory to assure that the method appropriate to the sample matrix and RDL is chosen from the specified method source. The most recently promulgated version should be used unless a specified version requested. The referenced SM methods are from the 18th edition of *Standard Methods for the Examination of Water and Wastewater*.
- (3) 'Laboratory Theory And Methods For Sediment Analysis, Chapter C1 of Techniques of Water-Resources Investigations of the United States Geological Survey,' 1969; Harold P. Guy, U.S. Geological Survey.

'Quality-Assurance Plan For The Analysis Of Fluvial Sediment By Laboratories Of The U.S. Geological Survey,' *U. S. Geological Survey Open-File Report 91-467*, Wilbur J. Matthes, Jr., Clyde J. Sholar, and John R. George, U. S. Geological Survey,
- (4) This referenced SM method is from the 19th edition of *Standard Methods for the Examination of Water and Wastewater*.

APPENDIX B

Field Forms

Soil & Water Database (SWD)

Report Date: 22-DEC-98

Field Event (SWDF_1100)

Sample Contractor: AS
Collection Date/Time: 23-DEC-98Sampler1: _____
Sampler2: _____
Sampler3: _____

Sample Event #: 99D4351-001

Sample Type: SW

Project: NPDES

Disposition: _____

Location: 995 EFF

Sample QC: REAL

Result Expected: YES

Sample QC Partner: _____

Event Comment: _____

Field Measurement	Result	Unit	Derivation Code	Derivation Comment
DO	_____	mg/L	DR2000	_____
PH	_____	S.U.	HORIBA	_____
TEMP(AIR)	_____	C	VWR THERMOMETER	_____
TEMP(H2O)	_____	C	HORIBA	_____
TRC	_____	mg/L	DR2000	_____
OIL/GREASE	_____	NO UNITS	VISUAL	_____
FLOW	_____	NO UNITS	VISUAL	_____

Line Item	Bottle Disposition	Collection Date/Time	Bottle Type	Volume	Preservative	Field Filtered	Matrix
8806B008 0800	_____	_____	_____	_____	_____	_____	_____
Lab: ACCU		RIN-Event.Bottle: 99D4351-001.001					
Shipment Date: _____		Bottle Comment: _____					
Turnaround Time: _____							

QC Signature/Date: _____
Last Date Updated: 22-DEC-98

DATE: _____

INVESTIGATION AREA:

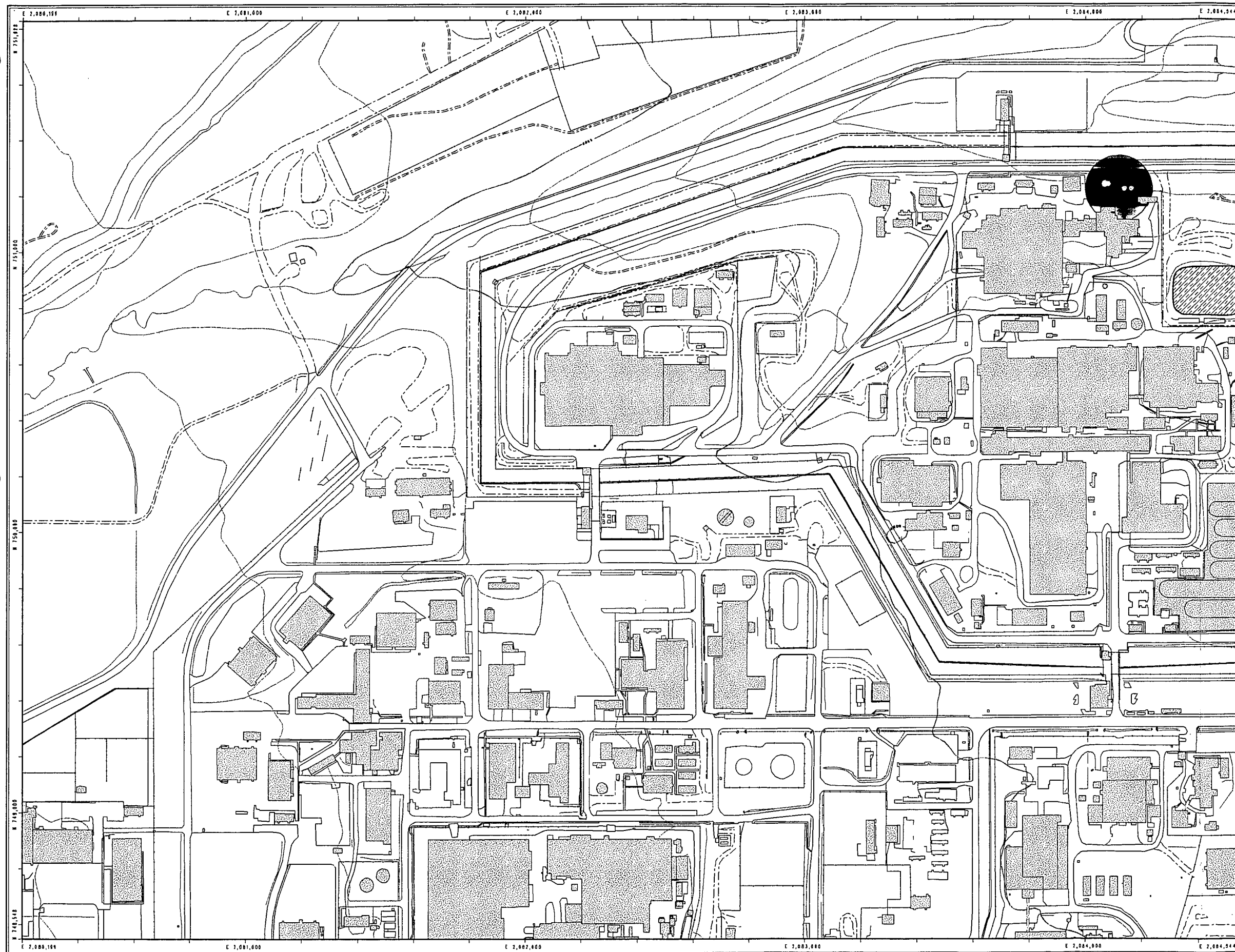
RIN#: 99A

SAMPLERS:

QC/PEER REVIEW:

Print/Sign/Date

[illegible]



Location Map

Figure 1.1

Bowman's Pond (PAC-700-1108) and
Steam Condensate Holding Tanks (IHSS 139.1N)

EXPLANATION

- Investigation Area

Standard Map Features

- Buildings and other structures
- Solar evaporation ponds
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences and other barriers
- Contour (20-Foot)
- Paved roads
- Dirt roads

DATA SOURCE:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas. Digitized from the orthophotographs. 1/96
Topology (contours) were derived from digital elevation model (DEM) data by Morrison Knudsen (MK) using ESRI Arc TIN and LATTICE to process the DEM data to create 5-foot contours. The DEM data was captured by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at ~10 meter resolution. The DEM post-processing performed by MK, Winter 1997.



Scale = 1 : 4230
1 inch represents approximately 353 feet

100 0 200 400 ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U. S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:

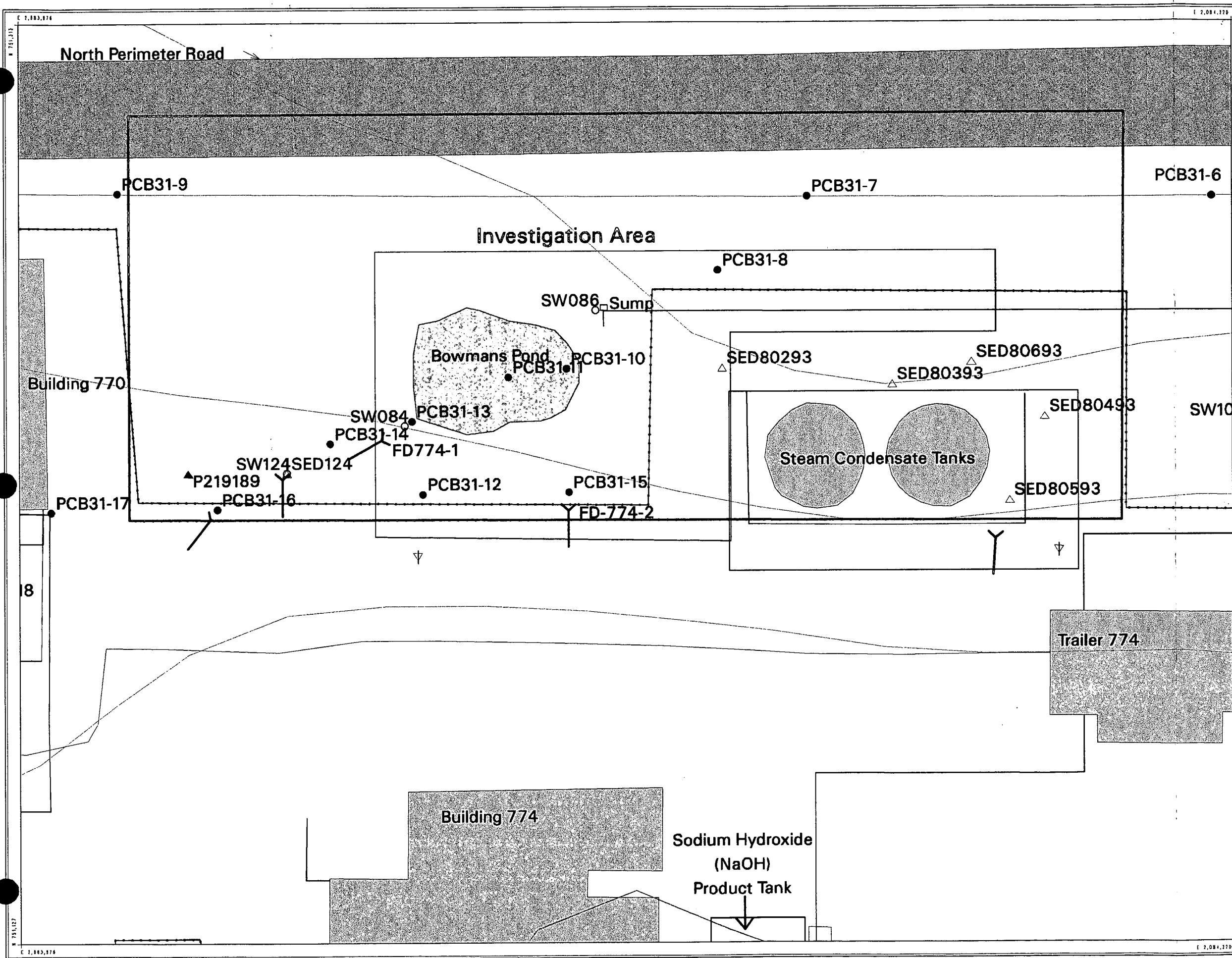


Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 484
Golden, CO 80402-4484

MAP ID: 89-0088

February 02, 1999

\\g22\projects\1998\89-0088\bowman_loc.apr



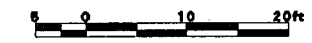
Sample Location Map
Figure 1.2
Bowman's Pond (PAC-700-1108) and
Steam Condensate Holding Tanks (IHSS 139.1N)

- EXPLANATION**
- PCB Samples
 - ▲ Groundwater Well Locations
 - Surface Water Locations
 - △ Sediment Sample Locations
 - ▭ PAC-700-1108 Boundary
 - Fence Line
 - Investigation Area
 - Footing Drain Outlet

- Standard Map Features**
- ▭ Buildings and other structures
 - ▨ Solar evaporation ponds
 - ▭ Lakes and ponds
 - Streams, ditches, or other drainage features
 - Contour (5-Foot)
 - Paved roads
 - Dirt roads



Scale = 1 : 230
1 inch represents approximately 19 feet



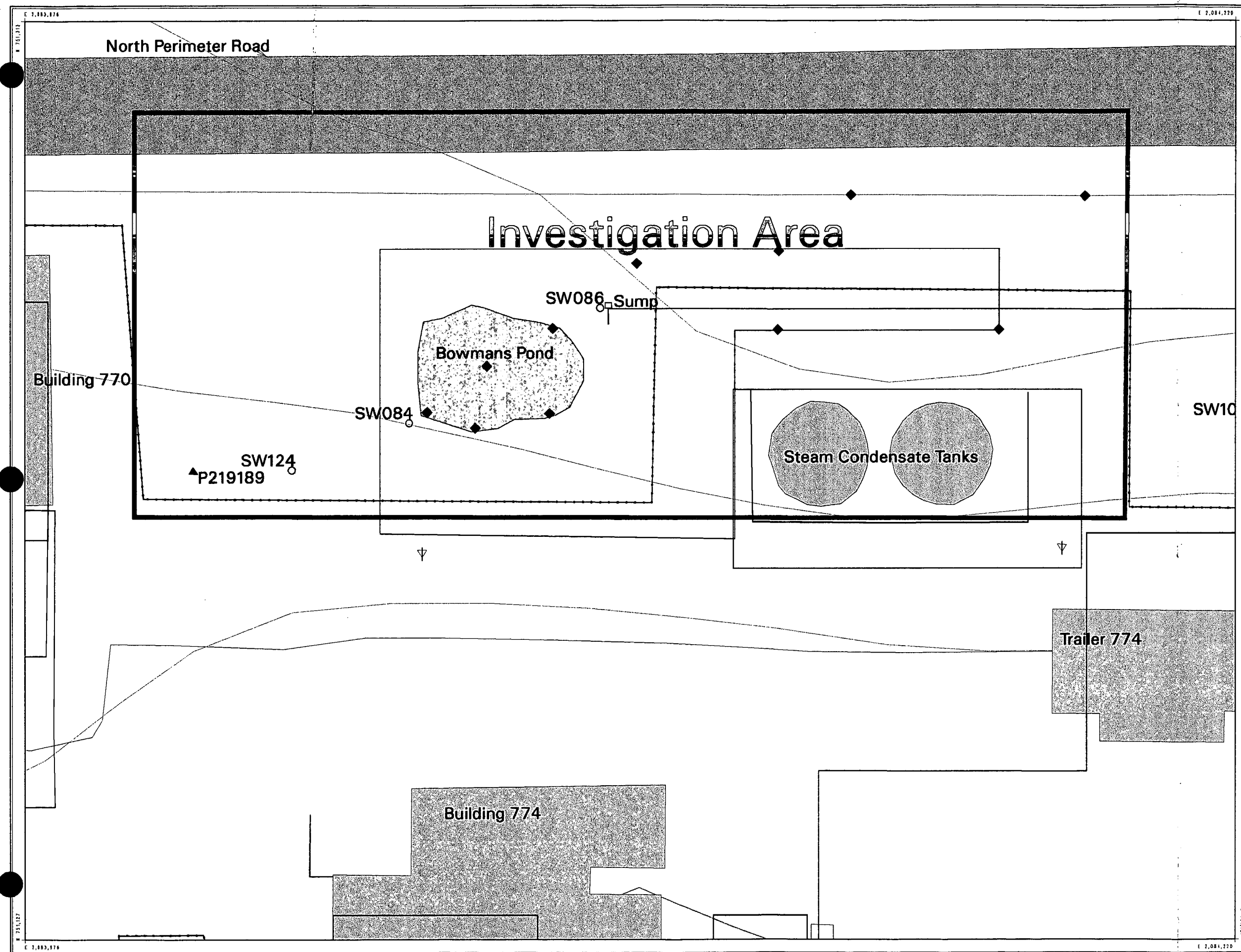
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
 Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 404
Golden, CO 80402-0404

MAP ID: 89-0059 February 02, 1999

\\gs2\projects\98\98-0059\hse_pac.am1



Proposed Sample Location Map

Figure 3.1

Bowman's Pond (PAC-700-1108) and
Steam Condensate Holding Tanks (IHSS 139.1N)

EXPLANATION

- ▲ Groundwater Well Locations
- Surface Water Locations
- ◆ Proposed Boreholes
- PAC-700-1108 Boundary
- Fence Line
- Investigation Area

Standard Map Features

- Buildings and other structures
- ▨ Solar evaporation ponds
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences and other barriers
- Contour (5-Foot)
- Paved roads
- Dirt roads



Scale = 1 : 230
1 inch represents approximately 19 feet



State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared
by:



**Rocky Mountain
Remediation Services, L.L.C.**
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 484
Golden, CO 80402-0484

MAP ID: 99-0059

February 02, 1999

7a1e2/projects/ryse/99-0059/fig3-1.mxd